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AUTHOR Wetterling, C.; Wheatley, J.
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ABSTRACT

One of two individualized courses included in a drafting curriculum, this course is designed to develop the fundamental skills of drafting using mechanical instruments. The course is comprised of thirteen units: (1) Mechanical Drawing, (2) Lettering, (3) Geometric Construction, (4) Shape Description, (5) Multiview Projection and Drawing Reproduction, (6) Dimensioning, (7) Section Views, (8) Auxiliary Views, (9) Templates, (10) Pictorial Drawings, (11) Mapping, (12) Intersections and Developments, and (13) Working Drawings. Each unit begins with a Unit Learning Experience Guide that gives directions for unit completion. The remainder of each unit consists of Learning Activity Packages (LAP) that provide specific information for completion of a learning activity. Each LAP is comprised of the following parts: objective, evaluation procedure, resources, procedure, supplemental sheets, study guide, and a LAP test with answers. The course is preceded by a pretest which is designed to direct the student to units and performance activities. (LRA)

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MOUNTAIN PLAINS LEARNING EXPERIENCE GUIDE:

Drafting

Course: Basic Drawing

CE027785

U.S. DEPARTMENT OF HEALTH,
EDUCATION & WELFARE
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Family Education Program

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Learning Experience Guide

COURSE: BASIC DRAWING

DESCRIPTION:

Basic Drawing is a course designed to develop the fundamental skills of drafting using mechanical instruments. The course includes lettering, sketching, instrument useage, geometric construction, dimensioning, and multi-view projection. Students will prepare drawings according ASNI specifications and develop skills in accuracy, line conventions, neatness and speed.

RATIONALE:

Many problems which exist in the world today are caused by the fact that people do not understand each other. There are many different languages, dialects, and interpretations of words which can lead to poor communication and misunderstanding. This causes a breakdown in the exchange of technical information.

There is one universal language, however, which is understood by all men. It is the language of pictures or otherwise known as the "Graphic" language. There are two types of drawings which man has adopted, to serve his purposes: 1) Artistic, and 2) Technical. In this course, we will only deal with the latter. Technical drawings are used in all industrial related occupations and workers, called draftsmen, must possess certain skills to keep the language of drawing universal. We will study those basic techniques.

PREREQUISITES:

Prescribed entry levels in Math and Communication Skills.

OBJECTIVES:

The student will develop skills in tool useage lettering, geometric construction, shape description, (orthographic projection) orthographic and other forms of projection, dimensioning, intersections, developments, mapping and working drawings.

RESOURCES:

*Start with the Printed Materials on Resource list.

GENERAL INSTRUCTIONS:

This course has thirteen units. Each unit has a Unit Learning Experience Guide (LEG) that gives directions for unit completion. Each unit consists of Learning Activity Packages (LAPs) that provide specific information for completion of a learning activity. Pretesting results direct the student to units and performance activities.

Principal Author(s): C. Wetterling, J. Wheatley

GENERAL INSTRUCTIONS (continued):

The general procedure for this course is as follows:

1. Read the assigned Unit LEG for this course.
2. Begin and complete the first assigned LAP as explained in the Unit LEG "General Instructions".
3. Proceed to, and complete, the remaining LAPs in the unit.
4. Take the unit tests as described in the Unit LEG "Evaluation Procedures."
5. Proceed to the next assigned unit in this course.
6. Follow steps 1 through 4 for all required units for this course.
7. Take the course post test as described in the "Evaluation Procedure."

*NOTE: As a draftsperson you will be expected to work independently--the more independent you are, the better. Therefore, in this course, you will be expected to work independently, unless directed to do otherwise. In most LAPs you will be directed to specific reference books. You are expected to read and find out as much as possible from these and other available texts before asking questions of your instructor. The resources may or may not be available or may not give you the best explanation. When this occurs check the other available resources.

UNIT TITLES:

.01	Mechanical Drawing
.02	Lettering
.03	Geometric Construction
.04	Shape Description
.05	Multiview Projection and Drawing Reproduction
.06	Dimensioning
.07	Section Views
.09	Auxillary Views
.10	Templates
.11	Pictorial Drawings
.12	Mapping
.13	Intersections and Developments
.14	Working Drawings

EVALUATION PROCEDURE:

Course evaluation is by pre and post testing using a multiple-choice type of test, and thru performance testing.

A course pretest is used to determine which units, if any, the student may be able to validate. The student is considered validated for a particular unit if 4 out of 5 items are correctly answered for each LAP part on the course pretests and if the student also satisfactorily completes the unit performance test. Unit performance tests validation procedures are given in the "Evaluation Procedure" section of the Unit Learning Experience Guide (LEG).

A course post test will also be taken by the student to determine any changes resulting from taking all or part of the course.

Printed Materials

1. Basic Technical Drawing. Spencer and Dygdon, Macmillan Company, New York, 1968.
2. Catalog collection (Building Trades supplies).
3. Drafting Technology. Rotmans and Horton, Delmar Publishers, 1967.
4. Engineering Drawing and Graphic Technology. Eleventh Edition, French and Vierck, McGraw-Hill Book Company, 1973.
5. Mechanical Drawing. French and Svenson, Webster Division, McGraw-Hill Book Company, 1968.
6. Technical Drawing. Sixth Edition, Giesecke, Mitchell, Spencer and Hill, Macmillan Company, 1974.
7. Technical Drawing Problems. Series 1, Giesecke, Spencer, Mitchell and Hill, Macmillan Company, 1967.
8. Assorted references as required by individual need.

Audio/Visuals

1. Drafting Series. (Set of 5 filmstrips and audio/cassette tapes), Doubleday Media.
2. Video cassettes (coded to each unit) -- FTC produced.

Equipment

1. Basic drafting tools: adapter, compass
    - board, drafting
    - brush, drafting
    - drawing set
    - eraser, electric
    - erasing shield
    - French curve
    - holder, lead
    - holder, pan (Leroy)
    - knife, X-acto
    - lead pointer
    - lettering guide, Ames or equivalent
    - lettering instrument, mechanical (Leroy or equivalent)
    - pens, Leroy (sizes as required)
    - protractor
    - scale, architect
    - scale, engineer
    - scissors
    - scriber, Leroy
    - templates, Leroy (#120, 140, and 175)
    - templates (assorted to need)
    - triangles (30° x 60° and 45°)
    - T-square
2. Diazo developer and printer.
3. Light box (minimum 24" x 36").
4. Cutter, paper (24" or larger).
5. Drafting furniture: stool, drafting
    - table, drafting (with T-square, parallel rule and/or drafting machine).
    - light, drafting
6. Player, audio/cassette.
7. Projector, filmstrip.
8. Transfer materials and tapes.
9. Sony video cassette player/monitor.

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Family Education Program

COURSE PRE/POST TEST: BASIC DRAWING

79.01.01.01

1. Hard leads are used:

   a. for general purpose work in mechanical drawing.
   b. when extreme accuracy is required and for basic construction lines.
   c. for art work but not for mechanical drawing.
   d. only on hard paper.

2. Medium leads are:

   a. used only on medium paper.
   b. used when extreme accuracy is required and for basic construction lines.
   c. the standard leads for general purpose work in mechanical drawing.
   d. used for art work.

3. Object lines (visible lines) are:

   a. lighter and thinner than construction lines.
   b. made with a 6-H lead and are the same weight as center lines.
   c. heavier than center lines or extension lines.
   d. made with a soft lead like 2-B or 2-F.

4. Wherever possible, pencil lines should be:

   a. wider than ink lines.
   b. thinner than ink lines.
   c. wider or thinner than ink lines.
   d. the same width as ink lines.

5. In our course, it is suggested you use which lead for construction lines:

   a. 2-H
   b. H
   c. 4-H
   d. 6-H

79.01.01.02

6. When mounting paper to the drawing board, the top edge of the paper is lined up with:

   a. tape and tacks.
   b. a large triangle.
   c. the compass geometric method.
   d. the top (working) edge of the T-square.

79.01.01.02 (continued)

7. The paper is held to the board with:

   a. nails or brads.
   b. glue.
   c. drafting paste.
   d. staples, thumb tacks, or tape.

8. Paper is attached to the board by right handers in which sequence?

   a. Lower right, upper right, lower left, upper left.
   b. Lower left, upper left, lower right, upper right.
   c. Lower right, lower left, upper right, upper left.
   d. Upper left, lower right, upper right, lower left.

9. If the drawing paper is not cut straight, it should be:

   a. aligned by using the straightest edge possible.
   b. thrown away.
   c. used for scratch paper.
   d. returned to the storage cabinet.

10. Drawing paper should be placed:

    a. up-side down.
    b. on top of the T-square.
    c. away from the working edge and close to the bottom of the board.
    d. close to the working edge and away from the bottom of the board.

79.01.01.03

11. To draw a horizontal line, the T-square should be held:

    a. at the end of the blade.
    b. firmly and tight against the paper.
    c. with the compass or dividers.
    d. loosely and away from the paper.

12. When drawing horizontal lines, the lead holder should be held:

    a. 45 degrees to the paper in the direction of the line.
    b. 60 degrees to the paper in the direction of the line.
    c. vertical to the paper in the direction of the line.
    d. 30 degrees to the paper in the direction of the line.

13. A horizontal line is drawn:

    a. from left to right if you are right handed.
    b. from right to left if you are right handed.
    c. from left to right if you are left handed.
    d. from left to right or right to left.

79.01.01.03 (continued)

14. When drawing horizontal lines, the lead holder should be:

   a. turned from side to side.
   b. held firmly and not rotated.
   c. rotated as rapidly as possible.
   d. rotated slowly to wear the point evenly.

15. When drawing horizontal lines, the head of the T-square is held:

   a. on top of the board.
   b. loosely.
   c. firmly against the working edge of the board.
   d. on the bottom of the board.

79.01.01.04

16. When drawing vertical lines, the lead holder should be held:

   a. 45 degrees to the paper in the direction of the line.
   b. 60 degrees to the paper in the direction of the line.
   c. 30 degrees to the paper in the direction of the line.
   d. vertical to the paper in the direction of the line.

17. When drawing vertical lines, the lead holder should be:

   a. held firmly and not rotated.
   b. turned from side to side.
   c. rotated as rapidly as possible.
   d. rotated slowly to even wear on the lead.

18. To draw a vertical line, you would use:

   a. the T-square with the head held against the top of the board.
   b. the architects scale.
   c. either you 30/60 triangle or your 45^0 triangle.
   d. your drawing set.

19. When drawing vertical lines and great accuracy is required:

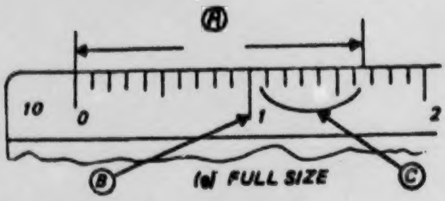
   a. toe the lead holder in against the T-square.
   b. toe the lead holder in against the triangle.
   c. use a harder drawing board.
   d. don't draw the line.

20. When drawing vertical lines and the edge of the triangle is too sharp:

   a. throw it away.
   b. sand the edge lightly with #00 sand paper.
   c. sharpen the lead.
   d. don't draw the line.

79.01.01.05

FIGURE #1


A
10
0
1
2
B
(a) FULL SIZE
C

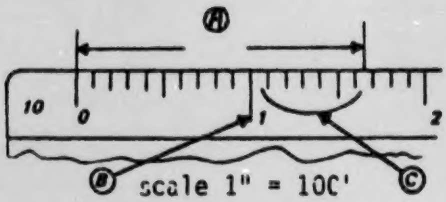
21. In Figure # 1, distance A is:

    a. 1.65 inches.
    b. 1½ inches.
    c. 2.5 inches.
    d. 3 1/16 inches.

22. In Figure # 2, distance 0 to B is:

    a. 1 inch.
    b. 100 inches.
    c. 100 feet.
    d. 10 feet.

FIGURE #2


A
10
0
1
2
B
scale 1" = 100'
C

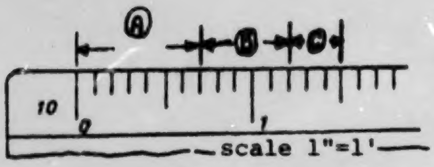
23. In Figure # 2, the 10 means:

    a. 10 graduations to the inch.
    b. 10 inches to the graduation.
    c. a 10 to 1 scale.
    d. the scale is 10 inches long.

24. In Figure # 2, the distance form 0 to 2 is:

    a. 2 inches.
    b. 20 meters.
    c. 200 feet.
    d. 200 units.

FIGURE #3

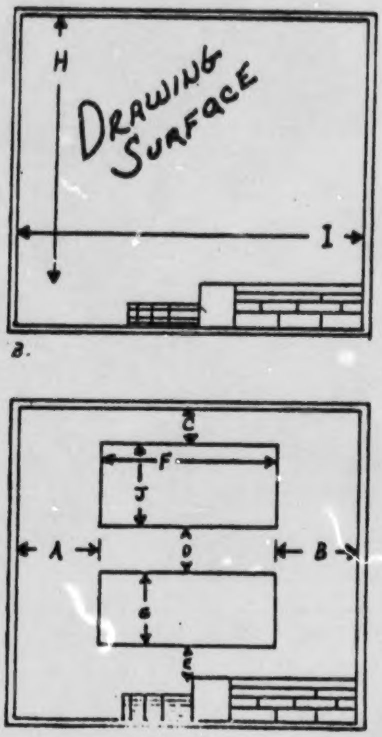

A
B
C
10
0
1
scale 1"=1'

25. In Figure # 3, distance A represents:

    a. 7 feet.
    b. .7 inch.
    c. 7 meters.
    d. .7 feet

79.01.01.06

FIGURE #4



26. When centering a two view drawing:

    a. distance A can be any length you decide.
    b. distance A never equals distance B.
    c. distance A always equals 2 inches.
    d. distance A always equals distance B.

27. The formula for vertical spacing is: (use Figure #4)

    a. A plus B divided by 2.
    b. A plus B divided by 3.
    c. H minus (J plus G) divided by 2.
    d. H minus (J plus G) divided by 3.

28. The formula for horizontal spacing in a 2 view drawing is: (use Figure #4)

    a. I minus F divided by 2.
    b. I minus F divided by 3.
    c. C plus D plus E divided by 2.
    d. C plus D plus E divided by 3.

79.01.01.06 (continued)

29. When spacing a two-view drawing, the width of the top and front views is:

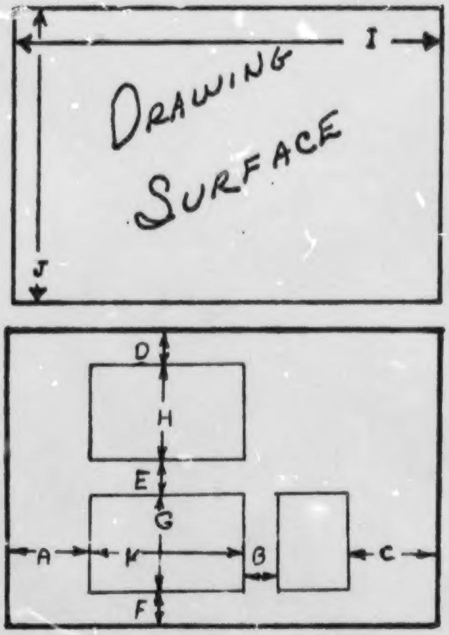
    a. different by 1 inch.
    b. the same.
    c. different by 2 inches.
    d. different by 3 inches.

30. Using Figure #4, what dimension represents object height?

    a. H
    b. J
    c. D
    d. G

79.01.01.07

FIGURE #5



31. When centering a 3-view drawing (as in Figure #5):

    a. distances A and B are always equal.
    b. distances D and F are always equal.
    c. distances D and C are always equal.
    d. distances H and G are always equal.

79.01.01.07 (continued)

32. The formula for horizontal spacing is: (use Figure #5)

    a. A ÷ B + C ÷ by 3.
    b. I - (2 X K) ÷ by 2.
    c. (A + B + C) ÷ by 2.
    d. I - (K + H) ÷ by 2.

33. The first step in drawing a 3-view drawing is to:

    a. draw circles and arcs.
    b. draw horizontal lines.
    c. draw vertical lines.
    d. determine the spacing.

34. The formula for vertical spacing is: (use Figure #5)

    a. J - (H + G) ÷ by 2.
    b. J - (H X 2) ÷ by 3.
    c. J - (H + E + G) ÷ by 2.
    d. (D + E + F) ÷ by 3.

35. What dimension on Figure #5, represents object width:

    a. H
    b. K
    c. G
    d. J

79.01.01.08

36. When drawing ink lines, the ruling pen should be:

    a. at an angle of 45^0 to the paper in the direction of the line.
    b. at an angle of 60^0 to the paper in the direction of the line.
    c. at an angle of 90^0 to the paper in the direction of the line.
    d. at any angle that is comfortable.

37. When drawing ink lines, the automatic reservoir pen should be:

    a. at an angle of 60^0 to the paper in the direction of the line.
    b. at an angle of 90^0 to the paper in the direction of the line.
    c. at an angle of 45^0 to the paper in the direction of the line.
    d. at any angle that is comfortable.

38. Thicker ink lines with the ruling pen are caused by:

    a. fresh ink and a clean pen.
    b. rapid movement of pen.
    c. sharp nibs.
    d. all the above.

79.01.01.08 (continued)

39. When inking or tracing a pencil line, the ink line should be:

  a. above the pencil line.
  b. centered over the pencil line.
  c. below the pencil line.
  d. longer than the pencil line.

40. Lettering, straight lines, curves, and arcs can be done with:

  a. the ruling pen, LeRoy pen, and lead holder.
  b. lead holder, ruling pen, LeRoy pen, and pencil.
  c. ruling pen and LeRoy pen.
  d. LeRoy pen and lead holder.

79.01.01.09

41. In Figure #6, B shows:

  a. a visible line covering a center line.
  b. a visible line behind a center line.
  c. a visible line behind a hidden line.
  d. a visible line covering a hidden line.

FIGURE #6

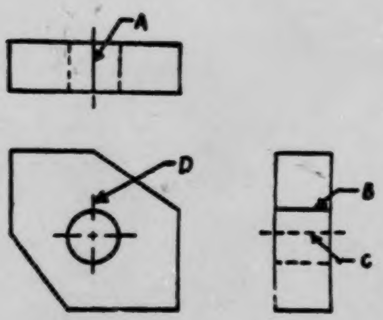
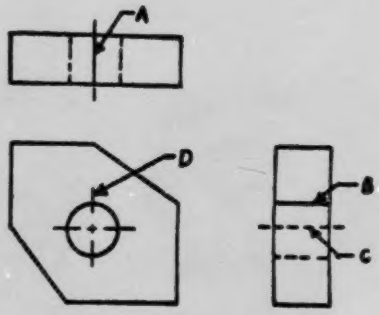


FIGURE #7



42. In Figure #7, C shows:

  a. a visible line covering a hidden line.
  b. a hidden line covering a center line.
  c. a hidden line covering a visible line.
  d. a visible line covering a center line.

43. In Figure #7, A is a:

  a. center line.
  b. hidden line.
  c. visible line.
  d. construction line.

79.01.01.09 (continued)

44. In Figure #7, D is a:

a. visible line.
b. center line.
c. hidden line.
d. construction line.

45. The correct order of line precedence is:

a. hidden, center, and visible.
b. center, visible, and hidden.
c. visible, center, and hidden.
d. visible, hidden and center.

79.01.01.10

46. Objectives in drafting are:

a. accuracy, speed, legibility, and neatness.
b. equipment, instruments, books, and pencils.
c. reading, slow drawing, ink and test books.
d. neat drawings, slow work and no accuracy.

47. A pencil drawing, not for reproduction, is made on:

a. polyester film.
b. tracing cloth.
c. tracing paper.
d. drawing or detail paper.

48. To draw mechanical curves other than circles or circular arcs use a:

a. compass.
b. electric eraser.
c. drafting machine.
d. french curve.

49. To save time when drawing symbols and repetitive features, use:

a. templates.
b. compasses.
c. T-square and triangle.
d. a drafting machine.

50. To make accurate measurements without damaging the scale:

a. take measurements directly off the scale with dividers or compass.
b. place the scale on the drawing and make short dashes at right angles to the scale.
c. use a ruler.
d. set off distances individually by moving the scale to a new position each time.

79.01.02.01

51. The U.S. Standard Style of Lettering is most often used on:

    a. architectural drawings.
    b. machine drawings.
    c. mapping drawings.
    d. all of the above.

52. The most common letter height used on drawings is:

    a. 1/2"
    b. 1/4"
    c. 1/8"
    d. 1/16"

53. The height relationship of lower case letters to upper case letters in U.S. Standard is:

    a. 1/2 or 2/3
    b. 3/4 or 3/5
    c. 1/2 or 3/4
    d. 3/5 or 2/3

54. Which of the following is the correct method of writing fractions using the U.S. Standard Lettering Style?

    a. $\frac{1}{2}$
    b. 3/4
    c. $\frac{5}{8}$
    d. 7/16

55. For proper spacing of the letters in a word:

    a. every letter should be an equal distance apart.
    b. the areas between letters should be equal.
    c. the space between letters should be equal to the letter O.
    d. each letter should be 1/16" apart.

79.01.02.02

56. Which spacing is not available on the Ames Lettering Guide?

    a. 1/8"
    b. 1/10"
    c. 5/32"
    d. all are available

57. The Ames can be used for drawing:

    a. vertical guide lines.
    b. inclined guide lines.
    c. horizontal guide lines.
    d. all the above.

58. The Ames Letter Guide is used with:

    a. 6H lead in a lead holder.
    b. 2H lead in a lead holder.
    c. the LeRoy Scriber.
    d. a compass and lead.

79.01.02.02 (continued)

59. The numbers on the bottom of the disc in the Ames instrument indicate:

a. the number of letters to the inch.
b. the heights of letters in thirty-seconds of an inch.
c. the angle to use for slant lettering.
d. the fractions that can be drawn.

60. The Ames lettering instrument is used to:

a. draw capital letters.
b. draw small letters.
c. draw guide lines.
d. draw numbers.

79.01.02.03

61. The numbers on the LeRoy templates (80, 100, 120, etc.) indicate:

a. the letter height in thousandths of an inch.
b. the number of letters to the inch.
c. the recommended pen size.
d. the letter height in thirty-seconds of an inch.

62. The numbers on the LeRoy template (00, 0, 1, 2, etc.) indicate:

a. the number of letters to the inch.
b. the recommended pen size.
c. the letter height in thousandths of an inch.
d. the letter height in thirty-seconds of an inch.

63. When using the LeRoy, the template is placed:

a. along a french curve.
b. along a straightedge.
c. on top of the scriber.
d. on top of the varigraph.

64. The LeRoy Scriber can be adjusted to:

a. scribe edge letters.
b. draw script letters.
c. draw vertical letters only.
d. draw inclined letters.

65. Which template will make the largest letters?

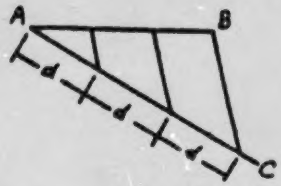
a. 61-1250-24PC c. 61-300-350CL
b. 61-300-290CL d. 61-300-80CL

79.01.03.01

66. Figure #8 is a solution to the problem of:

a. drawing lines parallel to AB.
b. dividing line A into a number of equal parts.
c. constructing a development.
d. dividing line AB into number of equal parts.

FIGURE #8



67. Two lines which are parallel are two lines which:

a. divide one another into two equal parts.
b. extend in the same direction and never intersect.
c. form a 90° angle with one another.
d. never touch the horizon.

79.01.03.02

68. To intersect means to:

a. cut across.
b. divide into two equal parts.
c. use a compass on it.
d. use dividers.

69. To bisect means to:

a. construct a line at 90° to another line.
b. split into parts.
c. divide into 3 equal parts.
d. divide into 2 equal parts.

79.01.03.03

70. Which of the methods below is not a method of enlarging a drawing?

a. grid squares
b. diagonal
c. axionometric
d. proportional

71. Which of the methods of enlarging a drawing use a special dividers?

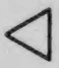
a. grid squares
b. diagonal
c. axoinometric
d. proportional

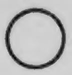
79.01.03.04

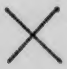
72. The interior angles of any triangle total up to:

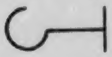
a. more than 0 degrees but less than 90 degrees.
b. 90 degrees.
c. 180 degrees.
d. more than 90 degrees but less than 180 degrees.

73. An example of a polygon is:

a. 

b. 

c. 

d. 

79.01.03.05

74. A triangle with two sides equal and two angles equal is:

a. right triangle.	c. obtuse.
b. scalene.	d. isosceles.

75. A triangle with no sides or angles equal is:

a. isosceles.	c. equilateral.
b. obtuse.	d. scalene.

79.01.03.06

76. The side of a right triangle that is opposite the right angle is:

a. the secant.	c. the hypotenuse.
b. the chord.	d. the isosceles.

77. If you bisect the angles of a triangle, the bisectors will:

a. be concentric.
b. be perpendicular to each other.
c. meet at one point.
d. pass through the center of the opposite side.

79.01.03.07

78. An equilateral triangle has:

    a. a 90 degree angle.
    b. three sides unequal.
    c. three sides equal.
    d. at least one 75 degree angle.

79. An equilateral triangle contains at least one angle of:

    a. 60^0 c. 45^0
    b. 30^0 d. 90^0

79.01.03.08

80. The diagonal of a square:

    a. is twice the length of a side.
    b. bisects a corner angle of the square.
    d. is perpendicular to a corner angle.
    d. bisects a side of the square.

81. The sum of the interior angles of a square is:

    a. 90^0
    b. 180^0
    c. 360^0
    d. dependent on the length of the sides.

79.01.03.09

82. When a square is inscribed in a circle, the diagonal of the square:

    a. bisects the sides of the square.
    b. is the diameter of the circle.
    c. is the radius of the circle.
    d. is equal to the perimeter of the circle.

83. When a square is inscribed in a circle, the center point of the circle:

    a. is on a corner of the square.
    b. lies on a side of the square.
    c. is closer to the angles of the square than the sides.
    d. is at the intersection point of the diagonals.

79.01.03.10

84. To circumscribe a square on a circle means:

a. to place the circle outside the square.
b. to place the square inside the circle.
c. to place the square outside the circle.
d. to place the corners of the square on the circle.

85. When a square is circumscribed on a circle:

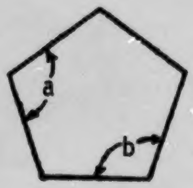
a. the length of a side is the diameter of the circle.
b. the length of a side is the radius of the circle.
c. the length of the diagonal is the diameter of the circle.
d. the length of the diagonal is the radius of the circle.

79.01.03.11

86. Figure #9 shown below is:

a. an octagon.
b. a pentagon.
c. a decagon.
d. a hexagon.

FIGURE #9



87. The interior angle A shown in Figure #9 is:

a. 72 degrees.
b. a right angle.
c. 108 degrees.
d. not equal to angle B.

79.01.03.12/.13

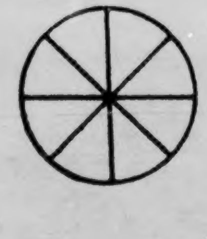
88. The interior angle of a hexagon is:

a. 60^o
b. 120^o
c. 30^o
d. the same as a square.

89. The construction shown in Figure #10 below is preliminary to the completion of:

a. a pentagon.
b. a nonagon.
c. a octagon.
d. a hexagon.

FIGURE #10



79.01.03.12/13 (continued)

90. In all hexagons, the distance from the center point to a vertex is:

a. equal to the diameter of a circle inscribed within the hexagon.
b. equal to the length of a bisector.
c. shorter than the length of a side of the hexagon.
d. equal to the length of a side of the hexagon.

79.01.03.14

91. An octagon has how many vertexes?

a. 4
b. 6
c. 8
d. 10

92. What is the sum of the interior angles of an octagon?

a. 135°
b. 360°
c. 720°
d. 1080°

79.01.03.15

93. A straight line which connects 2 points on the perimeter of a circle or arc and does not pass through the center is a:

a. chord.
b. diameter.
c. radius.
d. tangent.

94. Two circles or arcs which have a common center are said to be:

a. tangent.
b. concentric.
c. eccentric.
d. ellipsoidal.

79.01.03.16

95. A method of finding the center of an arc or circle is to:

a. construct a line tangent to the circle or arc.
b. rectify the arc or circle.
c. intersect the arc or circle.
d. bisect any 2 chords on the arc or circle.

79.01.03.17

96. A line that is tangent to a circle:

a. is perpendicular to the circle's radius at the tangent point.
b. is parallel to the circle's diameter at the tangent point.
c. touches the circle in 2 places.
d. passes through the center of the circle.

79.01.03.18

97. An arc tangent to a straight line:

a. touches the line at one point only.
b. passes through the line at the point of tangency.
c. bisects the line.
d. uses the line as a diameter.

79.01.03.19

98. To locate the center of a circle tangent to two intersecting straight lines, you would:

a. bisect each line.
b. construct lines perpendicular to the circle.
c. construct lines parallel to the given lines and the radius of the circle away.
d. bisect the angle between the lines.

79.01.03.20

99. To find the point of tangency of two tangent circles, draw:

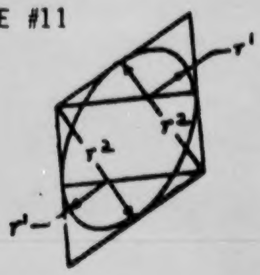
a. a straight line connecting the circle centers.
b. a perpendicular to the arcs.
c. a straight line parallel to the plane of intersection.
d. an arc with radius of R + R1.

79.01.03.21

100. The quickest and easiest method of drawing an ellipse is:

a. the 4-center method.
b. with a template.
c. the trammel method.
d. the concentric circle method.

FIGURE #11



101. The method of drawing an ellipse shown in Figure #11 is:

a. the concentric circle method.
b. the trammel method.
c. the axes method.
d. the approximate four-center method.

102. Which of the following ellipses would appear the flatest?

a. one with a major diameter of 2" and minor diameter of 1 3/4".
b. one with a major diameter of 9" and a minor diameter of 6".
c. one with a major diameter of 6" and a minor diameter of 2".
d. one with a major diameter of 2" and a minor diameter of 1".

79.01.03.21 (continued)

103. If the major axis and the minor axis of an ellipse are equal, the ellipse is:

a. approximate.
b. accurate.
c. a line.
d. a circle.

104. The most accurate method of drawing an ellipse is:

a. with a template.
b. by the 4-center method.
c. by the concentric circle method.
d. by the trammel method.

79.01.03.22

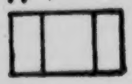
105. Learning the correct methods of geometric construction is important because:

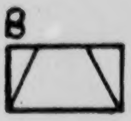
a. geometric construction jobs pay well.
b. all objects are made of points, straight lines or curves.
c. you cannot pass the post test without it.
d. it will help you with template work.

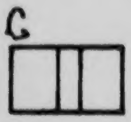
79.01.04.01

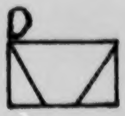
106. The top view of Figure #12 should look like:

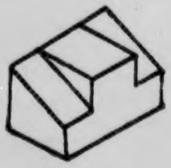
FIGURE #12

A


B


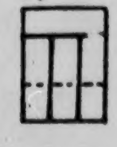
C


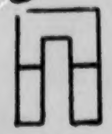
D


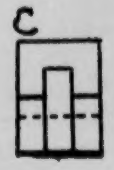


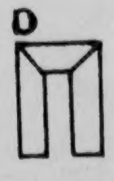
107. The right side view of Figure #13 should look like:

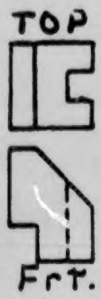
FIGURE #13

A


B


C


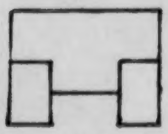
D




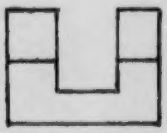
79.01.04.01 (continued)

108. The front view of Figure #14 should look like:

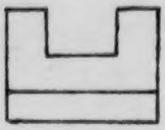
A



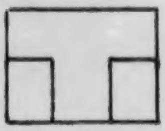
B



C



D



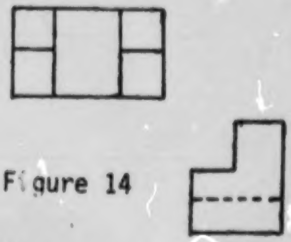


Figure 14

109. The depth dimension of an object can be found in:

a. the front and top view.
b. only the right side view.
c. the top and right side view.
d. only the top view.

110. The top, front, and right side vews are:

a. the only views possible.
b. the easiest to draw.
d. the most common views used in Mech Dwg.
d. always necessary to show an object.

79.01.04.02/03

111. An easy way to project dimensions is the:

a. miter method.
b. four point method.
c. horizontal method.
d. vertical method.

112. Another method of transfering dimensions is to measure from a reference line using:

a. the 30-60 triangle.
b. the lead holder.
c. the 3-point ruler.
d. the dividers.

113. Which of the views are numbered correctly with respect to Figure #15?

a. top
b. front
c. right side
d. none

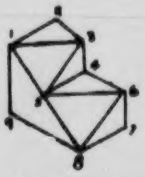
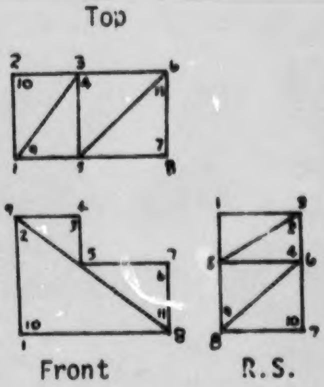


FIGURE #15



79.01.04.02/03 (continued)

114. When drawing a 3-view orthographic projection, the height dimension is found in:

a. the top and front views.
b. the top and right side views.
c. the front and right side views.
d. all the views.

115. In orthographic projection, the projectors are:

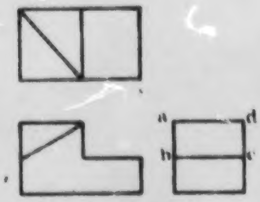
a. perpendicular to the plane of projection.
b. parallel to the plane of projection.
c. at a 45° angle to the plane of projection.
d. concentric with the plane of projection.

79.01.04.04

116. To complete the views in Figure #16, there should be:

a. an object line from b to d.
b. a hidden line from b to d.
c. an object line from a to c.
d. a hidden line from a to c.

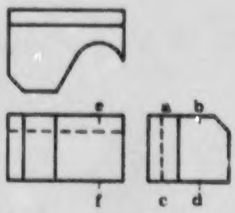
FIGURE #16



117. To complete the views in Figure #17, there should be:

a. an object line from e to f.
b. a hidden line from b to d.
c. an object line from a to c.
d. an object line from b to d.

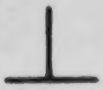
FIGURE #17



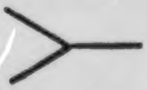
79.01.04.05/06

118. Isometric drawings should be made according to which axis shown below?

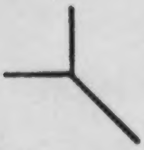
a.



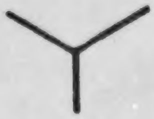
b.



c.



d.



79.01.04.05/06 (continued)

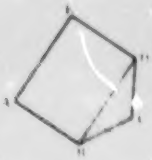
119. In an isometric drawing, the 90° angle between a horizontal plane and vertical plane appears as:

a. 90°
b. 120°
c. 45°
d. 30°

120. Which line in Figure #18 is not true length?

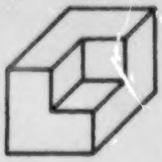
a. AB
b. BC
c. DC
d. DB

FIGURE #18

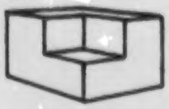


121. Which object below is an isometric projection of Figure #19?

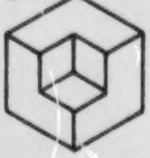
a.



c.



b.



d.

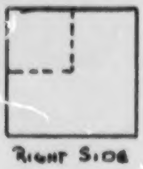
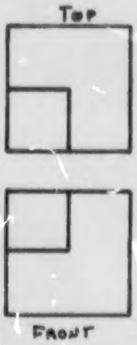


FIGURE #19



122. The term isometric means that all angles on the projection are:

a. equal.
b. parallel.
c. perpendicular.
d. not equal.

79.01.05.01

123. Multiview means:

a. one view.
b. two views.
c. two or more views.
d. three views.

124. The top view in a multiview drawing provides:

a. depth and height dimensions.
b. height and width dimensions.
c. depth and width dimensions.
d. no useful purpose.

79.01.05.01 (continued)

125. The top, front and bottom views are:

a. aligned horizontally and are the same height.
b. aligned vertically and are the same height.
c. aligned horizontally and are the same width.
d. aligned vertically and are the same width.

126. Depth dimensions in the top and right side views:

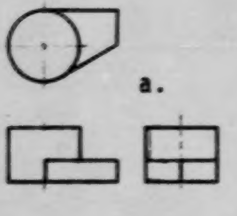
a. must correspond in the front and back.
b. must correspond with the bottom and left side views.
c. must correspond in all the views.
d. do not correspond in any view.

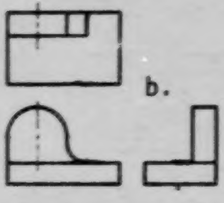
127. All points on a view will:

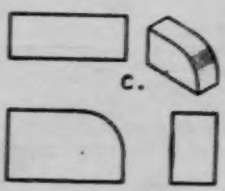
a. project to all other remaining views.
b. be visible points on the remaining views.
c. cannot be located on the remaining views.
d. be hidden points on the remaining views.

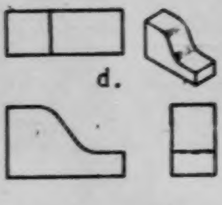
79.01.05.02

128. Which object below is drawn correctly?


a.

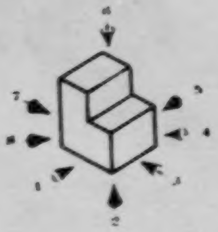

b.


c.


d.

129. The views necessary to completely describe the object shown in Figure #20 are:

FIGURE #20

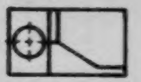


a. 1, 3, and 6.
b. 1, 6, and 7.
c. 1 and 4.
d. 1 and 3.

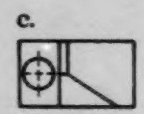
79.01.05.02 (continued)

130. The top view of Figure #21 looks like:

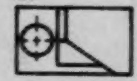
a.



c.



b.



d. none of these.

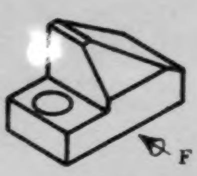


FIGURE #21

79.01.05.03/04

131. The type of reproduction process used in this class is:

a. blueprinting.
b. diazo printing.
c. lithograph.
d. xeroxing

132. Which speed of paper must be run at the slowest machine speed?

a. 10
b. 7
c. 5
d. print paper

133. If a print comes out with blue background, you should:

a. darken the lines.
b. erase the background.
c. speed the machine up.
d. slow the machine down.

134. Which combination of line and material requires the slowest speed setting on the machine?

a. ink, mylar, and speed 9 paper.
b. ink, vellum, and speed 10 paper.
c. pencil, mylar, and speed 9 paper.
d. pencil, vellum, and speed 10 paper.

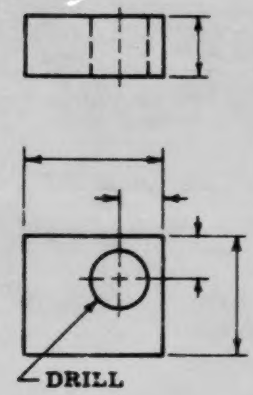
135. The reproduction process we use takes how many steps?

a. 1
b. 2
c. 3
d. 4

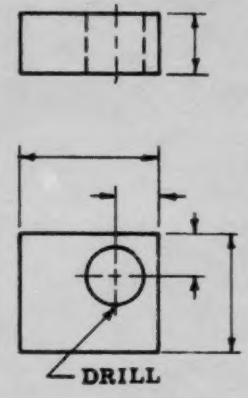
79.01.06.01-.04

136. The best method of dimensioning is:

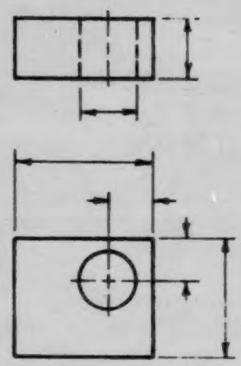
a.



b.



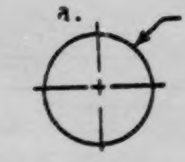
c.



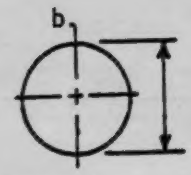
d. all are equally good.

137. The correct way to dimension a cylindrical object is:

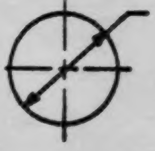
a.



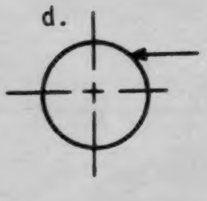
b.



c.



d.



138. Line 2 in Figure #22 is:

a. a dimension line.
b. an extension line.
c. a continuation line.
d. an object line.

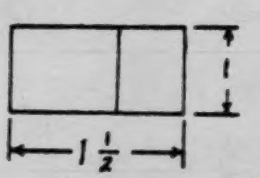


FIGURE #22

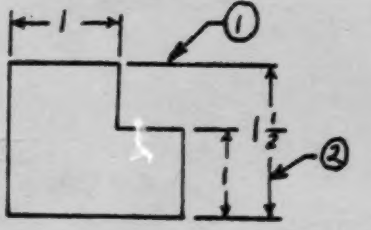
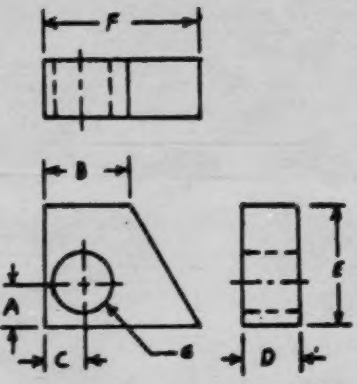


FIGURE #23

139. The size dimensions shown in Figure #23 are:

a. C, D, E, and F.
b. A, D, E, and F.
c. B, D, E, F, and G.
d. all dimensions are size dimensions.



79.01.06.01-.04 (continued)

140. The location dimensions in Figure #23 are:

a. D & B
b. A & C
c. A & B
d. E & F

141. Drawings should be made to scale, and the scale should be indicated:

a. on the object.
b. in the title block.
c. outside the border line.
d. only when smaller than full scale.

142. Dimensions are given in the form of:

a. linear distances, angles, or notes.
b. fractions only.
c. decimals only.
d. arrowheads.

143. If all dimensions are read from the bottom of the sheet, it is:

a. dimensioned poorly.
b. confusing.
c. the aligned method.
d. the unidirectional method.

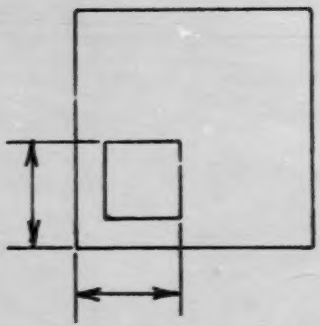
144. Which line below is not a type of line used as a dimension line?

a. extension
b. center
c. leader
d. hidden

145. The dimensions shown in Figure #24 are _________ dimensions.

a. equal
b. shape
c. size
d. location

FIGURE #24

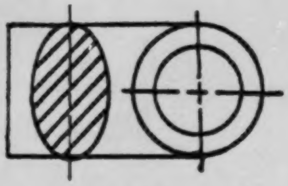


79.01.07.01-.09

146. The sectional view illustrated in Figure #25 is:

a. a turned section.
b. a removed section.
c. a revolved section.
d. a center section.

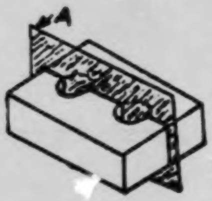
FIGURE #25



147. The sectional view produced according to plane A in Figure #26 would be:

a. an alternate section.
b. a half section.
c. an auxiliary section.
d. a full section.

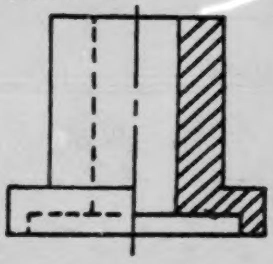
FIGURE #26



148. The sectional view illustrated in Figure #27 is:

a. a full section.
b. a one-fourth section.
c. a broken-out section.
d. a half section.

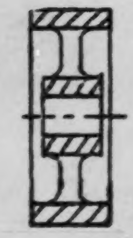
FIGURE #27



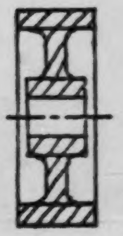
149. The correct sectional view of the Figure #28 is:

FIGURE #28

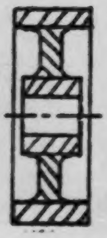
a.



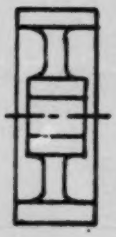
b.

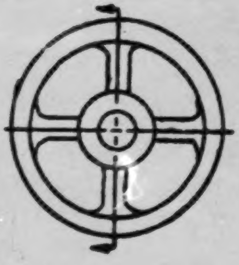


c.



d.



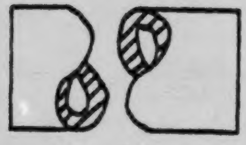


79.01.07.01-.09 (continued)

150. The object (Figure #29) represents a break in a long piece of:

- a. round solid material.
- b. elliptical solid material.
- c. elliptical tubular material.
- d. round tubular material.

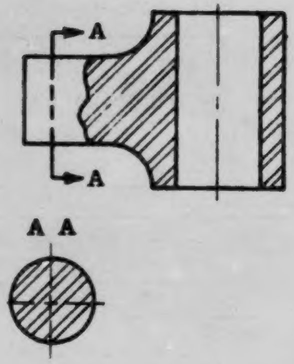
FIGURE #29



151. Section A-A on Figure #30 is a:

- a. broken out section.
- b. removed section.
- c. aligned section.
- d. auxiliary section.

FIGURE #30



152. Section lines may indicate what about an object?

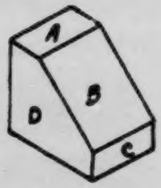
- a. the weight.
- b. the material.
- c. the density.
- d. the hardness.

79.01.09.01-.04

153. The plane shown in Figure #31 that would project true shape in an auxiliary view is:

- a. plane A.
- b. plane B.
- c. plane C.
- d. plane D.

FIGURE #31



79.01.09.01-.04 (continued)

154. An auxiliary view is a view which shows an angle surface:

a. from the side.
b. as a skewed plane.
c. true size and shape.
d. from above.

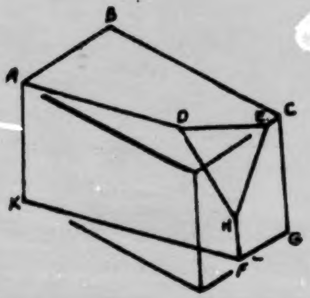
155. The plane that would project true shape in the rear view of Figure #31 is:

a. plane D.
b. plane A.
c. plane B.
d. plane C.

156. The Plane DEH shown in Figure #32 will project true shape in:

a. an auxiliary view.
b. the top view.
c. the right side view.
d. the front view.

FIGURE #32



157. Plane CGFHE shown in Figure #32 will project true shape in:

a. the right side view.
b. the front view.
c. the top view.
d. an auxiliary view.

79.01.09.05

158. A secondary auxiliary view is projected from which view?

a. primary auxiliary view.
b. right side view.
c. front elevation view.
d. top view.

159. A secondary auxiliary view is often necessary to show true size and shape of a(n):

a. line.
b. perpendicular surface.
c. angled surface.
d. skewed surface.

79.01.10.01-.04

160. Which of the following are the four commonly used types of templates.

   a. symbols, tapes, shapes, and heat.
   b. stencils, outlines, burnishers, and letters.
   c. burnishers, outlines, guides, and stencils.
   d. pressure, symbols, shapes, and objects.

161. Which of the objects below are not commonly drawn with templates?

   a. map symbols.
   b. electronic symbols.
   c. economic symbols.
   d. architectural symbols.

162. Which is not a reason to use templates?

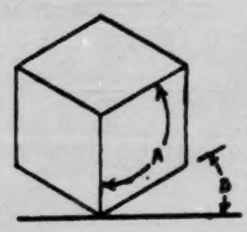
   a. they speed up the drawing.
   b. they are much more accurate than other methods.
   c. there is such a large variety of templates.
   d. they work well on repetative objects.

79.01.11.01

163. In an isometric drawing, angle B, shown in Figure #33 is:

   a. 60 degrees.
   b. 25 degrees.
   c. 20 degrees.
   d. 30 degrees.

FIGURE #33



164. In an isometric drawing, the number of principal views shown is:

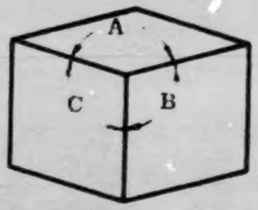
   a. four
   b. two
   c. one
   d. three

165. The type of axonometric projection shown in Figure #34 is:

   a. isometric.
   b. dimetric.
   c. trimetric.
   d. none of these.

A = B = C

FIGURE #34



79.01.11.01 (continued)

166. Measurements on an isometric drawing should be made:

a. vertical or horizontal.
b. with a metric scale.
c. parallel to the isometric axis.
d. so they are reduced by four-fifths.

167. All lines parallel to the isometric axis are:

a. perpendicular to the plane.
b. drawn true length.
c. angled surfaces.
d. drawn half size.

79.01.11.02/03

168. The receding axis in an oblique drawing is drawn at:

a. an angle of 120 degrees to the other axis.
b. 90 degrees to horizontal.
c. 90 degrees to vertical.
d. any angle between 15 degrees and 75 degrees.

169. A cavalier drawing is a type of:

a. oblique projection.
b. axonometric projection.
c. orthographic projecion.
d. perspective drawing.

170. When drawing a cabinet oblique, the angle that the projectors make with the plane of projection is always:

a. an oblique angle.
b. parallel.
c. 45 degrees.
d. 120 degrees.

171. When the receding lines are drawn to half size, the drawing is:

a. a cabinet projection.
b. a cavalier projection.
c. an orthographic projection.
d. a half-scale projection.

172. On an oblique drawing, the object is positioned so most of the arcs appear in:

a. the top plane. c. the left plane.
b. the front plane. d. the right plane.

79.01.11.02/03 (continued)

173. When drawing a cavalier drawing, the object is positioned so the profile view is shown:

a. true size and shape.
b. at an angle to the front.
c. in the top view.
d. in sections.

79.01.11.04/05

174. The first step in drawing an orthographic method perspective is to:

a. draw the top and front view.
b. draw the visual rays.
c. draw the parellels.
d. draw the vanishing point.

175. In a one-point perspective with the front surface on the picture plane, which dimensions are true size?

a. all of them.
b. the height and width.
c. the height and depth.
d. the width and depth.

176. In a two-point perspective, which dimension(s) is true length on the picture plane?

a. height.
b. depth.
c. width.
d. all of them.

177. The plane upon which a perspective view is projected is called:

a. the perspective plane.
b. the projection plane.
c. the picture plane.
d. the orthographic plane.

178. The position of the observer when looking at an object in perspective is called:

a. the vanishing point.
b. the picture plane.
c. the projection point.
d. the station point.

79.01.11.04/05 (continued)

179. When drawing a one point perspective using the orthographic method, the station point must be where with regard to the vanishing point?

a. to the left of.
b. to the right of.
c. on a horizontal line with.
d. on a vertical line with.

79.01.12.01-04

180. Given a traverse S 36° 15' E from a point, which traverse below would be the same line?

a. N 36° 15' W c. N 53° 45' W
b. N 36° 15' E d. S 53° 45' E

181. Which bit of information listed below in not contained on a plat?

a. station points.
b. land owner.
c. elevations.
d. directions and length of boundries.

182. What does the following notation represent: (sta 413 Ø FAP)

a. a fast action point.
b. a closed traverse.
c. a field transit symbol.
d. a reference point for measuring.

183. A map grid is used for what purpose?

a. to find station points.
b. to locate the transit.
c. to locate elevations.
d. to find traverses.

184. Any point on a given contour line:

a. is on the map grid.
b. has a different height then the next point.
c. is equal distance from the next contour line.
d. is the same height as all points on the contour line.

79.01.13.01-07

185. When drawing developments, the lengths of lines to use are:

a. the lengths from the front view.
b. the lengths from the top view.
c. their true lengths.
d. exactly one-half scale.

186. The drawing of all of the surfaces of an object to make a pattern is called:

a. auxiliary drawing.
b. intersection.
c. surface drawing.
d. development.

187. A prism with lateral edges that are not perpendicular to its base is:

a. a right prism.
b. an oblique prism.
c. a truncated cone.
d. a pipe offset.

188. Which of the following is the proper method of developing a cone?

a. triangulation.
b. parallel line.
c. radial line.
d. perpendicular line.

189. Which of the following is the proper method of developing a cylinder?

a. triangulation.
b. parallel line.
c. radial line.
d. perpendicular line.

79.01.14.01

190. Which of the following is not a design quality?

a. function
b. asthetics
c. shop processes
d. all are design qualities

191. Which of these objects listed below are concerned more with asthetics then function?

a. pictures, statues, and paintings.
b. chairs, tables, and desks.
c. buildings, autos, and planes.
d. stereos, radios, and clocks.

79.01.14.02

192. The detail drawing usually consists of:

a. isometric views with the dimensions.
b. dimensioned orthographic views.
c. orthographic views without dimensions.
d. isometric views without dimensions.

79.01.14.02 (continued)

193. Details of several parts of an assembly may be drawn on one sheet:

   a. in patents drawings only.
   b. on the assembly drawing.
   c. if space permits.
   d. at no time.

194. All necessary information not given directly on the detailed drawing with notes and dimensions must be shown in:

   a. the assembly drawing.
   b. the bill of materials.
   c. the title block.
   d. none of the above.

79.01.14.03

195. The following are four general types of assembly drawings. Which one does not show hidden lines and minor details?

   a. general assemblies (exploded).
   b. working drawing assemblies (detail).
   c. installation assemblies (outline).
   d. design assemblies (layout).

196. The working drawing assembly is:

   a. drawn in isometric.
   b. very detailed with all the hidden lines.
   c. drawn orthographic without the hidden lines.
   d. not drawn as a rule.

197. The title strip should contain:

   a. the drawing title, company name, sheet #, date, and draftsperson's name.
   b. all information on the size of the object.
   c. the name of the drawing and nothing else.
   d. all the materials needed for the object.

79.01.14.04

198. The bill of materials contains:

   a. the different materials and their cost.
   b. the name of the object and the draftsperson who drew it.
   c. information not contained on the detailed drawing.
   d. the cost of the object.

79.01.14.04 (continued)

199. Drawings that are line shaded, lettered in script, and protect a manufacturer are called:

a. security drawings.
b. old style drawings.
c. detailed drawings.
d. patent drawings.

200. The general assembly (exploded view) drawing is done as a(n):

a. cabinet drawing.
b. two-point perspective drawing.
c. oblique drawing.
d. isometric drawing.

CONGRATULATIONS
YOU
MADE
IT!

79.01.00.00. C2-0
November 26, 1979

BASIC DRAWING
COURSE PRE/POST TEST

79.01.01.01

1. B
2. C
3. D
4. D
5. D

79.01.01.02

6. D
7. D
8. D
9. A
10. D

79.01.01.03

11. B
12. B
13. A
14. D
15. C

79.01.01.04

16. B
17. D
18. C
19. B
20. B

79.01.01.05

21. A
22. C
23. A
24. C
25. D

79.01.01.06

26. D
27. D
28. A
29. B
30. D

79.01.01.07

31. B
32. D
33. D
34. C
35. B

79.01.01.08

36. B
37. B
38. A
39. B
40. D

79.01.01.09

41. D
42. B
43. C
44. B
45. D

79.01.01.10

46. A
47. D
48. D
49. A
50. B

79.01.02.01

51. B
52. C
53. D
54. A
55. B

79.01.02.02

56. D
57. D
58. A
59. B
60. C

79.01.02.03

61. A
62. B
63. B
64. D
65. C

79.01.03.01

66. D
67. B

79.01.03.02

68. A
69. D

79.01.03.03

70. C
71. D

79.01.03.04

72. C
73. A

79.01.03.05

74. D
75. D

79.01.03.06

76. C
77. C

79.01.03.07

78. C
79. A

79.01.03.08

80. B
81. C

79.01.03.09

82. B
83. D

79.01.03.10

84. C
85. A

79.01.03.11

86. B
87. C

79.01.03.12/13

88. B
89. C
90. D

79.01.03.14

91. C
92. D

79.01.03.15

93. A
94. B

79.01.03.16

95. D

79.01.03.17

96. A

79.01.03.18

97. A

79.01.03.19

98. C

79.01.03.20

99. A

79.01.03.21

100. B
101. D
102. C
103. D
104. C

79.01.03.22

105. B

79.01.04.01

106. A
107. C
108. B
109. C
110. C

79.01.04.02/03

111. A
112. D
113. C
114. C
115. A

79.01.04.04

116. B
117. B

79.01.04.05/06

118. D
119. B
120. D
121. B
122. A

79.01.05.01

123. C
124. C
125. D
126. B
127. A

79.01.05.02

128. C
129. A
130. C

79.01.05.03/04

131. B
132. C
133. D
134. A
135. B

79.01.06.01-04

136. A
137. A
138. A
139. C
140. B
141. B
142. A
143. D
144. D
145. D

79.01.07.01-09

146. C
147. D
148. D
149. A
150. D
151. B
152. B

79.01.09.01-04

153. B
154. C
155. A
156. A
157. A

79.01.09.05

158. A
159. D

79.01.10.01-04

160. C
161. C
162. B

79.01.11.01

163. D
164. D
165. A
166. C
167. B

79.01.11.02/03

168. D
169. A
170. C
171. A
172. B
173. A

79.01.11.04/05

174. A
175. B
176. A
177. C
178. D
179. D

79.01.12.01-04

180. A
181. C
182. D
183. C
184. D

79.01.13.01-04

185. C
186. D
187. B
188. C
189. B

79.01.14.01

190. D
191. A

79.01.14.02

192. B
193. C
194. B

79.01.14.03

195. C
196. B
197. A

79.01.14.04

198. C
199. D
200. D

Family Education Program

File Code: 79.01.01.00:A2-1

Date Published: 10-7-77

Revised: 8-14-79

Learning Experience Guide

UNIT: MECHANICAL DRAWING

RATIONALE:

In our technical society, there is a need for concise and clear communication. The graphic language is perhaps the best method for communicating ideas for industry. Even if you are only indirectly associated with industry, a knowledge of the graphic language is essential in order for you to read and draw blueprints. Confucius once said, "One picture is worth a thousand words." If you don't believe this, try telling someone how to build a house, or any object without using drawing.

PREREQUISITES:

Same as the course (see the course LEG).

OBJECTIVES:

Identify the types of lines and drafting instruments.
Use drafting instruments to measure and draw lines conforming to ANSI standards.

RESOURCES:

Printed Materials

Basic Technical Drawing, Spencer and Dygdon, Macmillan Company, New York, 1968.
Engineering Drawing and Graphic Technology. French and Vierck, Eleventh Edition, McGraw-Hill Book Company, New York.
Mechanical Drawing. French and Svenson, Webster Division, McGraw-Hill Book Company, New York.
Technical Drawing. Sixth Edition, Giesecke, Mitchell, Spencer and Hill, Macmillan Company, New York.

Equipment

Basic Drafting Tools: As indicated in the Course LEG.

GENERAL INSTRUCTIONS:

This unit consists of ten Learning Activity Packages (LAPs). Each LAP will provide specific information for completion of a learning activity.

The general procedure for this unit is as follows:

1) View the resource filmstrips/and/or/video cassette.
2) Read the first assigned LAP.
3) Begin and complete the first assigned LAP.

Principal Author(s): C. Wetterling

Revised: J. Wheatley

GENERAL INSTRUCTIONS: (continued)

4) Take and score the LAP test if indicated in the LAP.
5) Determine the reason for any missed items on the LAP test.
6) Proceed to and complete the next assigned LAP in the unit.
7) Complete all required LAPs for the unit by following steps 3 through 6.
8) In this unit, there are some LAPs that have tests combined with other LAP tests. These combined tests are taken after completing the last LAP covered by the test.
9) Take the unit tests as described in the Unit LEG "Evaluation Procedures".
10) Proceed to the next assigned unit.

PERFORMANCE ACTIVITIES:

.01 Identifying Drawing Leads and Line Weights.
.02 Mounting Paper on a Drawing Board.
.03 Drawing Horizontal Lines.
.04 Drawing Vertical Lines.
.05 Using the Engineer's Scale.
.06 Centering Two-View Drawings.
.07 Centering Three-View Drawings.
.08 Inking Techniques.
.09 Precedence of Lines.
.10 Applying Basic Mechanical Drawing Techniques.

EVALUATION PROCEDURE:

1. The student takes a multiple-choice unit post test and turns it in for evaluation. Success completion is a score of 80% or better.
2. The student takes a performance test.

Successful unit completion is meeting the listed criteria for the performance test.

FOLLOW-THROUGH:

Principles of measuring, line work and neatness will be used throughout the remainder of the course.

Begin the first assigned LAP after first reading Chapters 1 through 3 in Basic Technical Drawing and viewing filmstrip/video cassette on Introduction to Drafting - Unit 1.

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UNIT PRETEST: MECHANICAL DRAWING

79.01.01.01.

1. Examples of hard leads are:

   a. 2B,2H,2F.
   b. 2H,H,HB.
   c. 2B,4B,6B.
   d. 8H,6H,4H.

2. Examples of medium leads are:

   a. 8H,6H,4H.
   b. 2B,4B,6B.
   c. 2H,H,HB.
   d. 2B,2H,2F.

3. Examples of soft leads are:

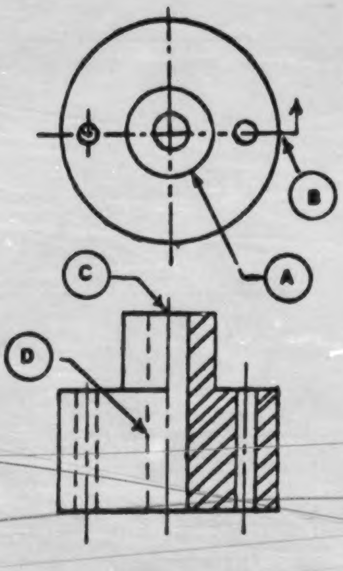
   a. 8H,6H,4H.
   b. 2B,4B,6B.
   c. 2H,H,HB.
   d. 2B,2H,2F.

4. Line A in figure at right is:

   a. an outline.
   b. a solid line.
   c. a visible line.
   d. an exterior line.

5. Line B in figure at right is:

   a. a cutting plane line.
   b. a section line.
   c. a center line.
   d. an object line.



79.01.01.02.

6. Left-handers should place the head of the T-square:

   a. on the right-hand side of the drawing board.
   b. on the bottom edge of the drawing board.
   c. on the left-hand side of the drawing board.
   d. on the top edge of the drawing board.

7. Right-handers should place the head of the T-square:

   a. on the left-hand side of the drawing board.
   b. on the bottom edge of the drawing board.
   c. on the top edge of the drawing board.
   d. on the right-hand side of the drawing board.

8. The working edge of the T-square is used to:

   a. align the drawing paper.
   b. clean the pencil.
   c. scrape off the board.
   d. adjust the compass.

9. When using thumb tacks, use the type with:

   a. extra long nail.
   b. serrated brad.
   c. thin smooth head.
   d. no head.

10. When mounting paper to the board, align the:

   a. left edge of the paper.
   b. top edge of the paper.
   c. right edge of the paper.
   d. bottom edge of the paper.

79.01.01.03.

11. When drawing horizontal lines, left-handers:

    a. follow the same procedure as right-handers.
    b. reverse the procedure for right-handers.
    c. follow any procedure desired.
    d. have no procedure to follow.

12. A horizontal line is drawn from:

    a. from left to right or right to left.
    b. left to right if you are left handed.
    c. right to left if you are right handed.
    d. right to left if you are left handed.

13. To maintain a symmetrical pencil point when drawing horizontal lines:

    a. hold the pencil tightly and do not rotate it.
    b. rotate the pencil slowly.
    c. rotate the pencil as rapidly as possible.
    d. turn the pencil from side to side.

14. The type of line drawn along the top of the T-square is:

    a. horizontal.
    b. vertical.
    c. curved.
    d. circles and arcs.

15. When drawing horizontal lines, the trail of graphite particles are:

    a. left where they fall.
    b. rubbed into the paper.
    c. removed by eraser.
    d. blown off at intervals.

79.01.01.04.

16. When drawing vertical lines, left-handers:

    a. have no procedure to follow.
    b. follow the same procedure as right-handers.
    c. follow any procedure desired.
    d. reverse the procedure for right-handers.

79.01.01.04. continued:

17. A vertical line is drawn:

    a. top to bottom if you are right handed.
    b. top to bottom if you are left handed.
    c. bottom to top if you are left handed.
    d. either top to bottom or bottom to top.

18. To maintain a symmetrical pencil point when drawing vertical lines:

    a. turn the pencil from side to side.
    b. hold the pencil tightly and do not rotate it.
    c. rotate the pencil as rapidly as possible.
    d. rotate the pencil slowly.

19. When drawing vertical lines, the pencil point is held:

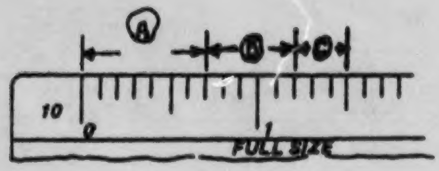
    a. with an eraser.
    b. by the finger tips.
    c. against sandpaper.
    d. a small space from the triangle.

20. When drawing vertical lines, the trail of graphite particles are:

    a. left where they fall.
    b. rubbed into the paper.
    c. remove by eraser.
    d. blown off at intervals.

79.01.01.05.

79.01.01.05. continued:



21. In the diagram, distance B is:

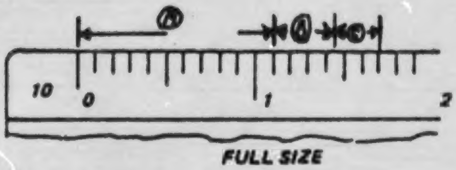
    a. 1/2 inch.
    b. 1.2 inches.
    c. 5/8 inch.
    d. 3/4 meters.

22. In the diagram, distance C is:

    a. 1 1/2 inch.
    b. 3/8 inch.
    c. 3/10 inch.
    d. 1/4 meters.

23. In the diagram, distance A plus distance B is:

    a. 1.2 inches.
    b. 1 meter.
    c. 1 inch.
    d. 1.2 meters.



24. In the diagram, distance A is:

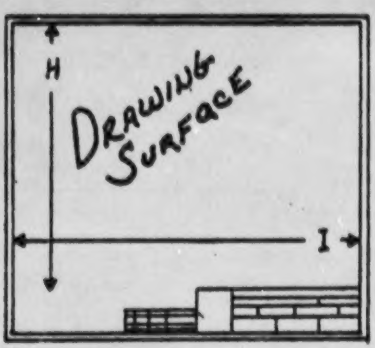
    a. 1 1/8 inches.
    b. 1 1/8 meters.
    c. 1 1/10 inches.
    d. 1 1/10 meters.

25. In the diagram, distance A plus distance B is:

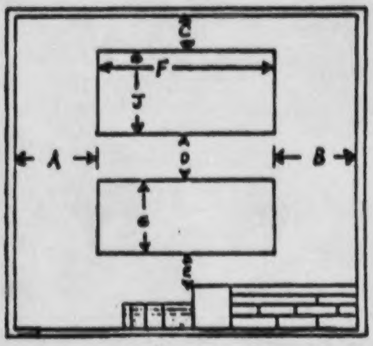
    a. 1.45 meters.
    b. 1.05 meters.
    c. 1.45 inches.
    d. 1.05 inches.

79.01.01.06.

26.



a.



26. When centering a two view drawing:

    a. distance B always equals distance C.
    b. distance B always equals distance G.
    c. distance B is always equal to distance A.
    d. distance B can be any length you decide.

27. When spacing a two-view drawing, the width of the top and front views is:

    a. different by 1 inch.
    b. the same.
    c. different by 2 inches.
    d. different by 3 inches.

28. When drawing a two-view drawing, the first step is to:

    a. determine the spacing between the views.
    b. draw horizontal construction lines.
    c. draw vertical construction lines.
    d. draw circles and arcs.

79.01.01.06. continued:

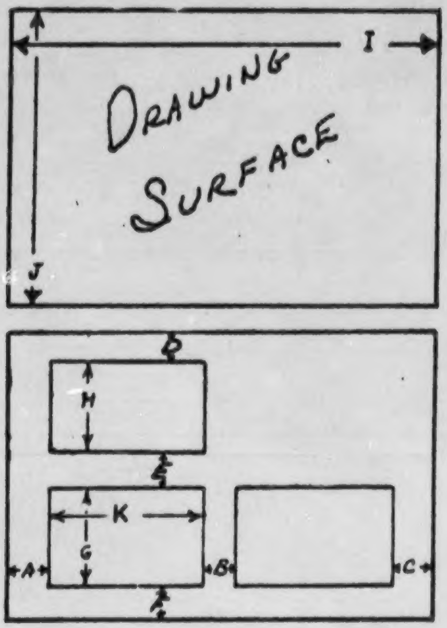
29. In a two-view drawing, corners of construction lines should:

    a. not be seen.
    b. just meet.
    c. not touch.
    d. cross.

30. The last step in making a two-view drawing is to:

    a. locate the center lines.
    b. erase the construction lines.
    c. heavy-in all final lines.
    d. make short marks to locate the views.

79.01.01.07.



31. When centering a three-view drawing:

    a. distance H and G are always equal.
    b. distance D and C are always equal.
    c. distance D and F are always equal.
    d. distance A,F, and C are always equal.

79.01.01.07.

32. The formula for horizontal spacing is:

    a. A plus B plus C divided by 3.
    b. I minus (2 times K) divided by 2.
    c. A plus B plus C divided by 2.
    d. I minus (K plus H plus B) divided by 2.

33. When spacing a three-view drawing, the width of the top and front views is:

    a. different by 1 inch.
    b. the same.
    c. different by 2 inches.
    d. different by 3 inches.

34. The first step in drawing a three-view drawing is to:

    a. draw circles and arcs.
    b. draw horizontal lines.
    c. draw vertical lines.
    d. determine the spacing.

35. Corners of construction lines in three-view drawings should:

    a. not be seen.
    b. just meet.
    c. not touch.
    d. cross.

79.01.01.08.

36. When inking or tracing a pencil line, the ink line should be:

    a. above the pencil line.
    b. centered over the pencil line.
    c. below the pencil line.
    d. longer than the pencil line.

37. The first lines to ink on a drawing are:

    a. construction lines.
    b. hidden lines.
    c. circles and arcs.
    d. section lines.

79.01.01.08. continued:

38. When drawing ink lines, the technical fountain pen should be:

    a. at an angle of 90° to the paper in the direction of the line.
    b. at an angle of 60° to the paper in the direction of the line.
    c. at any angle that is comfortable.
    d. at an angle of 45 to the paper in the direction of the line.

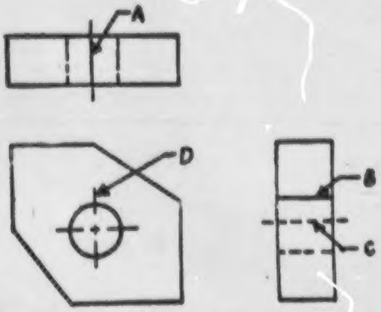
39. Ink lettering on a drawing is done:

    a. first.
    b. last.
    c. sometime in the middle.
    d. any time it is convenient.

40. The ruling pen is sharpened with:

    a. sandpaper.
    b. a hard Arkansas oil stone.
    c. an electric pen sharpener.
    d. a regular pencil sharpener.

79.01.01.09.



41. In the diagram, A shows:

    a. a hidden line behind a visible line.
    b. a visible line behind a center line.
    c. a visible line covering a center line.
    d. a hidden line covering a visible line.

79.01.01.09.

42. In the diagram, C shows:

    a. a visible line covering a hidden line.
    b. a hidden line covering a center line.
    c. a hidden line covering a visible line.
    d. a visible line covering a center line.

43. In the diagram, D is a:

    a. visible line.
    b. hidden line.
    c. construction line.
    d. center line.

44. A visible line always takes precedence over a:

    a. center line or hidden line.
    b. circle or arc.
    c. border line.
    d. title block.

45. A hidden line always takes precedence over a:

    a. circle or arc.
    b. visible line.
    c. center line.
    d. border line.

79.01.01.10.

46. Objectives in drafting are:

    a. accuracy, speed, legibility, and neatness.
    b. equipment, instruments, books, and pencils.
    c. reading, slow drawing, ink, and text books.
    d. neat drawings, slow work, and no accuracy.

47. The Parallel-Ruling Straightedge is used for:

    a. large drawings.
    b. small drawings.
    c. vertical lines.
    d. circles and arcs.

79.01.01.10. continued:

48. To replace the T-square, triangles, scales, and protractor use a:

    a. parallel-ruling straightedge.
    b. template.
    c. drafting machine.
    d. mylar sheet.

49. To draw mechanical curves other than circles or circular arcs, use a:

    a. compass.
    b. electric eraser.
    c. drafting machine.
    d. french curve.

50. To make accurate measurements:

    a. take measurements directly off the scale with dividers or compass.
    b. place the scale on the drawing and make short dashes at right angles to the scale.
    c. use a ruler.
    d. set off distances individually by moving the scale to a new position each time.

79.01.01.00. A2-2

UNIT PRETEST ANSWER KEY: MECHANICAL DRAWING

LAP		
01	1.	D
	2.	C
	3.	B
	4.	C
	5.	B
02	6.	A
	7.	A
	8.	A
	9.	C
	10.	B
03	11.	B
	12.	D
	13.	B
	14.	A
	15.	D
04	16.	D
	17.	D
	18.	D
	19.	D
	20.	D
05	21.	A
	22.	C
	23.	A
	24	C
	25.	C
06	26.	C
	27.	B
	28.	A
	29.	D
	30.	C
07	31.	D
	32.	D
	33.	B
	34.	D
	35.	D
08	36.	B
	37.	C
	38.	A
	39.	B
	40.	B
09	41.	C
	42.	B
	43.	D
	44.	A
	45.	C
10	46.	A
	47.	A
	48.	C
	49.	D
	50.	B

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Learning Activity Package

Student: ____________________

Date: ____________________

PERFORMANCE ACTIVITY: IDENTIFYING DRAWING LEADS AND LINE WEIGHTS & USING THE LEAD HOLDER & LEAD POINTER

OBJECTIVES:

Categorize leads according to their hardness, function, and Line Weight. Correctly use the Lead Holder and Lead Pointer.

EVALUATION PROCEDURE:

Successfully complete at least 80% of the items on a multiple-choice test about this LAP.

RESOURCES:

Basic Technical Drawing, para. 3.7 through 3.10, pp. 23-25.
Technical Drawing, p. 23.

PROCEDURE:

1. Read the above resource(s).

2. Read the following steps in identification of lead weights:

   a. Drawing leads are graded according to the amount of graphite contained in the lead. This accounts for the hardness of the lead and contributes to the width or weight of the line drawn.
   b. Hard pencils are used when extreme accuracy is required and for basic construction lines. Pencils in this group are: 9H, 8H, 7H, 6H, 5H, and 4H.
   c. Medium pencils are used for general purpose work in mechanical drawing (3H, 2H, and H). The softer pencils in this group are used for shading and sketching (F, HB, and B).
   d. Soft pencils should not be used in mechanical drawing. These are to be used for art work. Included in this group are 2B, 3B, 4B, 5B, 6B, and 7B.
   e. The Lead Weights to be used in this curriculum are:

      6H - Center lines, dimension lines, extension lines, and construction lines.
      4H - Hidden lines, section lines, phantom lines, and long break lines.
      2H - Object lines, cutting plane lines, short break lines, and arrow heads.
      H - Lettering.

Principal Author(s): Charles Dvorak, Jere Wheatley, Sheila Vosen

f. Suggested contrasts in line weight in ink (refer to Figure 2.16, page 23, Technical Drawing or Figure 3-11, page 26, Basic Technical Drawing), may also be applied to width of lines in lead. Notice that all lines maintain the same blackness. It is only the width which changes in order to create contrast for lines.

NOTE: These lead weights are suggested as a guideline for draftspersons becoming familiar with leads and line weights for the first time. Individually, you may find that the pressure you apply to the lead holder requires that you use a harder or softer lead than those suggested above. Part of becoming a draftsperson is learning what is best for you.

3. Obtain a set of drawing leads and holder case from the instructor.

   KEYPOINT: Remember the softer the pencil lead, the more it will smudge.

4. Read the following summary:

   a. Insert a lead in the lead holder. Use your thumb to apply pressure to the button at the top. This will expand the collet for the lead.
   b. Extend the lead 3/8" to 1/2" out of the holder.
   c. Insert the lead and lead holder into the lead pointer and rotate. (Different colored sleeves are used to identify the size of opening in the lead pointer).

5. Take the LAP test.

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LAP TEST: IDENTIFY DRAWING LEADS AND LINE WEIGHTS

1. Drawing leads are graded according to:
    - a. the amount of graphite contained in the lead.
    - b. letters of the alphabet (A, B, C, D, etc.) only.
    - c. numbers (1, 2, 3, 4, etc.) only.
    - d. the length of the pencil.

2. Hard leads are used:
    - a. for general purpose work in mechanical drawing.
    - b. when extreme accuracy is required for basic construction lines.
    - c. for art work but not mechanical drawing.
    - d. only on hard paper.

3. Medium leads are used:
    - a. only on medium paper.
    - b. when extreme accuracy is required and for basic construction lines.
    - c. for general purpose work in mechanical drawing.
    - d. for art work but not for mechanical drawing.

4. Examples of hard leads are:
    - a. 2B, 2H, 2F.
    - b. 2H, H, HB.
    - c. 2B, 4B, 6B.
    - d. 8H, 6H, 4H.

5. Examples of medium leads are:
    - a. 8H, 6H, 4H.
    - b. 2B, 4B, 6B.
    - c. 3H, 2H, H.
    - d. 2B, 2H, 2F.

6. Examples of soft leads are:
    - a. 8H, 6H, 4H.
    - b. 2B, 4B, 6B
    - c. 2H, H, HB.
    - d. 2B, 2H, 2F.

7. Construction lines should be made:

   a. with H or 2H lead.
   b. with F or H lead.
   c. with 6H or 8H lead.
   d. with B or 2B lead.

8. What length should the lead be extended from the lead holder for sharpening?

   a. 1/32" to 1/16".
   b. 1" to 2".
   c. 3/8" to 1/2".
   d. 2" to 3".

9. What identifies the size of opening on the lead pointer issued in your kit?

   a. the numbers 1, 2 and 3.
   b. each sharpener is a different size.
   c. the colored cap.
   d. none.

10. Construction lines should be barely seen at:

    a. arm's length.
    b. in the light.
    c. at 10".
    d. at l0'.

LAP TEST ANSWER KEY: IDENTIFY DRAWING LEADS AND LINE WEIGHTS

1. A
2. B
3. C
4. D
5. C
6. B
7. C
8. C
9. C
10. A

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Family Education Program

Learning Activity Package

Student: ____________________

Date: ____________________

PERFORMANCE ACTIVITY: Mounting Paper on a Drawing Board

OBJECTIVE:

Identify procedure for fastening paper to the drawing board. To identify standard paper sizes and their relationship.

EVALUATION:

Successfully complete at least 80% of the items on a multiple-choice test about this LAP.

RESOURCES:

Basic Technical Drawing, paragraph 3.6, page 22.

PROCEDURE:

1. Read the above resource(s).

2. There are five Standard American Drawing sizes:

    a. Size A -- 9 x 12
    b. Size B --12 x 18
    c. Size C --18 x 24
    d. Size D --24 x 36
    e. Size E --36 x 48

    * The sizes we use in this class are A, B, and C. Our paper stock contains only these sizes.

3. Read the following Key Points:

    a. Place paper fairly close (1½" to 2") to the working edge of the drawing board. NOTE: The working edge of the drafting board is that side which the head of the T-square butts against. For the right-handed draftsperson it is the left edge of the drafting board. For the left-handed draftsperson it is the right edge.

    b. Place a piece of tape on the top right (for left-handers) or left hand corner (for right-handers).

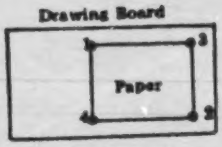
    c. Line up paper with T-square. NOTE: Paper is not always cut straight, therefore, use the straightest edge possible. Use only one edge of the T-square. Do not use both edges of the T-square. Grip T-square firmly on drawing board to prevent slipping when lining up paper.

Principal Author(s): Jere Wheatley

PROCEDURE: (continued)

d. Put tape on remaining corners diagonally. See example below:

NOTE: Illustration is for left-handers.



Working
Edge

KEYPOINT: Not all sheets will be fastened securely with only four pieces of tape. Use as many fasteners as necessary.

4. Take the LAP test.

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LAP TEST: MOUNTING PAPER ON A DRAWING BOARD

1. When mounting paper to the drawing board, the top edge of the paper is lined up with:

   a. tape and takcs.
   b. a large triangle.
   c. the compass geometric method.
   d. the top (working) edge of the T-square.

2. The paper is held to the board with:

   a. nails or brads.
   b. glue.
   c. drafting paste.
   d. staples, thumb tacks or tape.

3. Tracing paper should be fastened:

   a. directly to the board.
   b. only on the back side.
   c. to the T-square.
   d. over a drawing already on the board.

4. Paper is attached to the board in which sequence for right handed people:

   a. lower right, upper right, lower left, upper left.
   b. lower left, upper left, lower right, upper right.
   c. lower right, lower left, upper left, upper right.
   d. upper left, lower right, upper right, lower left.

5. The working edge of the drafting board is:

   a. on the left-hand side of the drawing board for right handers.
   b. on the bottom edge of the drawing board for both right and left handers.
   c. on the top edge of the drawing board for both right and left handers.
   d. on the right-hand side of the drawing board for right handers.

6. If the drawing paper is not cut straight, it should be:

   a. aligned by using the straightest edge possible.
   b. thrown away.
   c. used for scratch paper.
   d. returned to the storage caninet.

7. Drawing should be placed:

   a. upside down.
   b. on top of the T-square.
   c. away from the working edge of the board.
   d. close to the working edge of the board.

8. When using tape to hold down drawing paper, place it:

   a. over the border line.
   b. outside the border line.
   c. inside the border line.
   d. right on the border line.

9. When using thumb tacks, use the type with:

   a. extra long nail.
   b. serrated brad.
   c. thin smooth head.
   d. no head.

10. A special draftsman's stapler is used to:

   a. attach triangle to T-square.
   b. staple papers together.
   c. hammer thumb tacks.
   d. staple drawing paper to the drawing board.

LAP TEST ANSWER KEY: MOUNTING PAPER ON A DRAWING BOARD

1. D
2. D
3. D
4. D
5. A
6. A
7. D
8. B
9. C
10. D

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File Code: 79.01.01.03.A2-0

Date Published: 10/7/77

Learning Activity Package

Student: ____________

Date: ____________

PERFORMANCE ACTIVITY: DRAWING HORIZONTAL LINES

OBJECTIVE:

Identify the procedure for drawing horizontal lines.

EVALUATION PROCEDURE:

Successfully complete at least 80% of the items on a multiple-choice test about this LAP.

RESOURCES:

Basic Technical Drawing, para. 3.11, pg. 25.

PROCEDURE:

1. Read the above resource(s).
2. Read the following summary:
   - a. Right-handers: Place the T-square head against the left edge of the board. Left-handers: Place the T-square head against the right edge of the board.
   - b. Hold T-square firmly down on paper.
   - c. Hold lead holder at 60^0 angle with the paper in the direction of the line.
   - d. Rotate lead holder slowly to have uniform width in your lines.
   - e. Move lead holder away from T-square head.
   - f. Do not use the bottom of the T-square to make lines.
3. Take the LAP test.

Principal Author(s): Charles Dvorak
Sheila Vosen
Jere Wheatley

Student: ______________________ **File Code:** 79.01.01.03.A2-2

Date: ______________________ **Date Published:** 10/7/77

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LAP TEST: DRAWING HORIZONTAL LINES

1. To draw a horizontal line, the T-square should be held:

   a. at the end of the blade.
   b. with the compass or dividers.
   c. loosely and away from the paper.
   d. firmly and tight against the paper.

2. When drawing horizontal lines, the lead holder should be held:

   a. 60 degrees to the paper in the direction of the line.
   b. 30 degrees to the paper in the direction of the line.
   c. vertical to the paper in the direction of the line.
   d. 45 degrees to the paper in the direction of the line.

3. When drawing horizontal lines, the lead holder should be:

   a. turned from side to side.
   b. held firmly and not rotated.
   c. rotated as rapidly as possible.
   d. rotated slowly as you draw the line.

4. When drawing horizontal lines, the head of the T-square is held:

   a. on top of the board.
   b. firmly against the working edge of the board.
   c. on the bottom of the board.
   d. loosely.

5. When drawing horizontal lines and great accuracy is required:

   a. toe-in the pencil against the T-square.
   b. sharpen the pencil to a fine point.
   c. raise the T-square.
   d. use a harder drawing board.

6, When drawing horizontal lines and the edge of the T-square is too sharp:

   a. don't draw the line.
   b. throw it away.
   c. use the other side of the T-square.
   d. sand the edge lightly with No. 00 sandpaper.

7. When drawing horizontal lines, left handers:

   a. follow same procedure as right handers.
   b. reverse the procedure for right handers.
   c. follow any procedure desired.
   d. have no procedure to follow.

8. To maintain a symmetrical pencil point when drawing horizontal lines:

   a. hold the pencil tightly and do not rotate it.
   b. rotate the pencil slowly.
   c. rotate the pencil as rapidly as possible.
   d. turn the pencil from side to side.

9. When drawing horizontal lines, the pencil point is held:

   a. against sandpaper.
   b. by the finger tips.
   c. a small space from the T-square.
   d. with an eraser.

10. When drawing horizontal lines, the trail of graphite particles are:

    a. left where they fall.
    b. rubbed into the paper.
    c. removed by eraser.
    d. blown off at intervals.

LAP TEST ANSWER KEY: DRAWING HORIZONTAL LINES

1. D
2. A
3. D
4. B
5. A
6. D
7. B
8. B
9. C
10. D

File Code: 79.01.01.04. A2-0

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Revised: 8-14-79

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Learning Activity Package

Student:

Date:

PERFORMANCE ACTIVITY: DRAWING VERTICAL LINES

OBJECTIVE:

Identify procedures for drawing vertical lines.

EVALUATION PROCEDURE:

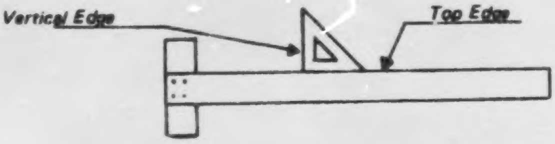
Successfully complete at least 80% of the items on a multiple-choice test about this LAP.

RESOURCES:

Basic Technical Drawing, para. 3.12, pg. 26.

PROCEDURE:

1. Read the above resource(s).
2. Read the following summary:
   a. Use the T-square and either the 30 x 60 degree or the 45 degree triangle.
   b. Place the triangle on the top edge of your T-square as shown in the illustration below. NOTE: Vertical side of the triangle is toward the T-square head.

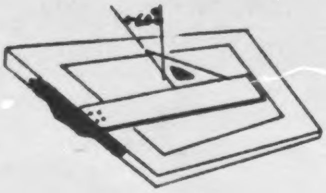


   c. All vertical lines must be drawn using this method. (You must not slide the head of the T-square along the top edge of the drawing board.)
   d. Hold T-square and triangle firmly.

Principal Author(s): C. Wetterling
Sheila Vosen
Jere Wheatley

e. With your lead holder leaning approximately 60 degrees to the paper, draw a line upward. Rotate the lead holder slowly as you draw the line. NOTE: Rotating the lead holder helps to draw uniform lines.

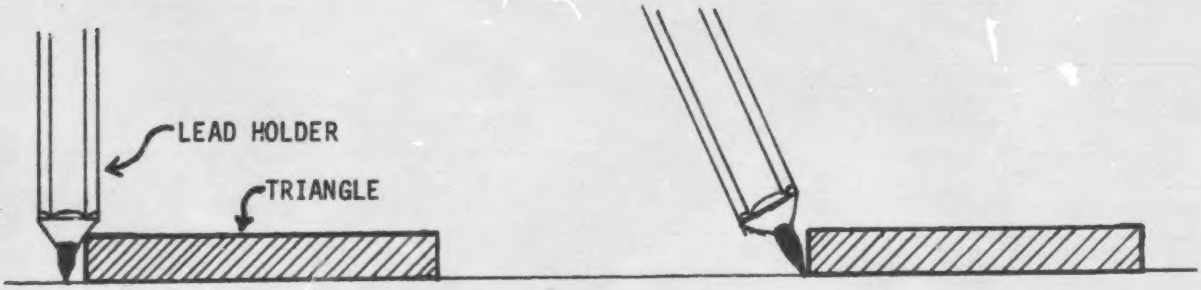
EXAMPLE:



KEY POINT:

1. For extreme accuracy, use the lead against the lower edge of the triangle.

EXAMPLE: First drawing showing small space between lead holder point and triangle. Second drawing shows position for greater accuracy.



3. Take the LAP Test.

Student: ______________________ File Code: 79.01.01.04.A2-2

Date: ______________________ Date Published: 10/7/77

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LAP TEST: DRAWING VERTICAL LINES

1. To draw a vertical line, place the triangle on the T-square with:

    a. the vertical edge on the right if you are right handed.
    b. the vertical edge on the left if you are right handed.
    c. the vertical edge on the left if you are left handed.
    d. the vertical edge on either the left or the right.

2. When drawing vertical lines, the lead holder should be held:

    a. 45 degrees to the paper in the direction of the line.
    b. 60 degrees to the paper in the direction of the line.
    c. 30 degrees to the paper in the direction of the line.
    d. vertical to the paper in the direction of the line.

3. A vertical line is drawn from:

    a. bottom to top if you are right handed.
    b. top to bottom if you are right handed.
    c. top to bottom if you are left handed.
    d. either top or bottom.

4. When drawing vertical lines, the lead holder should be:

    a. held firmly and not rotated.
    b. turned from side to side.
    c. rotated as rapidly as possible.
    d. rotated slowly.

5. When drawing vertical lines and great accuracy is required:

    a. toe-in the lead holder against the T-square.
    b. toe-in the lead holder against the triangle.
    c. use a harder drawing board.
    d. raise the triangle.

6. When drawing vertical lines, left handers:

    a. have no procedure to follow.
    b. follow the same procedure as right handers.
    c. follow any procedure desired.
    d. reverse the procedure for right handers.

7. When drawing vertical lines, the T-square should be held:

   a. loosely and away from the paper.
   b. at the end of the blade.
   c. with the compass or dividers.
   d. firmly and tightly against the paper.

8. A vertical line is drawn:

   a. top to bottom if you are right handed.
   b. top to bottom if you are left handed.
   c. bottom to top if you are left handed.
   d. either top or bottom.

9. To maintain a symmetrical lead point when drawing vertical lines:

   a. turn the lead holder from side to side.
   b. hold the lead holder tightly and do not rotate it.
   c. rotate the lead holder as rapidly as possible.
   d. rotate the lead holder slowly.

10. When drawing vertical lines, the lead point is held:

    a. with an eraser.
    b. by the finger tips.
    c. against sandpaper.
    d. a small space from the triangle.

LAP TEST ANSWER KEY: DRAWING VERTICAL LINES

1. B
2. B
3. A
4. D
5. B
6. D
7. D
8. C
9. D
10. D

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Date Published: 10/7/77
Revised: 8-14-79

Learning Activity Package

Student: ______

Date: ______

PERFORMANCE ACTIVITY: USING THE ENGINEER'S SCALE

OBJECTIVE:

Correctly measure given lines using the Engineer's Scale.

EVALUATION PROCEDURE:

Lines measured are without error.

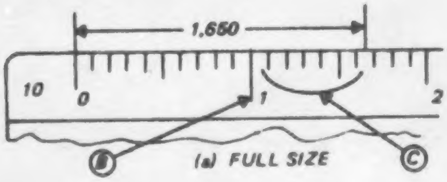
Successfully complete at least 80% of the items on a multiple-choice test about this LAP.

RESOURCES:

Basic Technical Drawing, para. 3.22 and 3.23, pg. 36.
Engineer's Scale.

PROCEDURE:

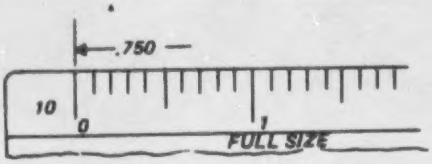
1. Read the above resource(s).
2. Read the following summary:
   a. The Engineer's Scale is set up on the decimal system.
   b. Each inch is divided into units of 10, 20, 30, 40, 50, or 60 parts. (Each division on the 10 scale is .1", 20 scale .05", 30 scale is .033", 40 scale is .025, 50 scale .02" and 60 scale is .167").
   c. To measure 1.650 full size on the Engineer's Scale, the following steps are taken:
      1) Use the 10-scale.
      2) Set off one main division.
      3) Next, set off 6½ subdivisions.



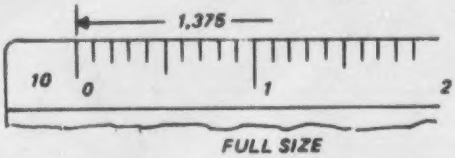
Principal Author(s): Charles Dvorak

4. Do the following:

   a. Now measure .750 on the 10-scale by drawing extension lines.



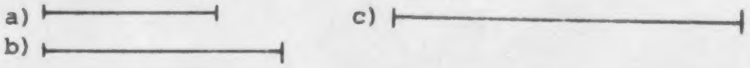
   b. Now measure 1.375 in the same manner.



NOTE: To measure a dimension half-size, use the 20-scale.

To measure a dimension one-quarter size, use the 40-scale.

   c. Measure the following lines using the 20-scale.



   d. Measure the same lines using the 40-scale.

ANSWERS

20 Scale
(a) ________
(b) ________
(c) ________

40 Scale
(a) ________
(b) ________
(c) ________

5. Check your measurements with the answer key.

6. Return the Engineer's Scale to the instructor.

7. Take the LAP test.

Student: ______________________ **File Code:** 79.01.01.05.A2-2

Date: ______________________ **Date Published:** 10/7/77

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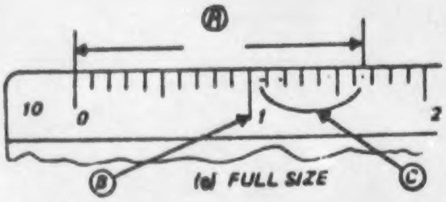
LAP TEST: USING ENGINEER'S SCALE

1. The engineer's scale is graduated in:
   - a. the vector system.
   - b. the unidirectional system.
   - c. the metric system.
   - d. the decimal system.

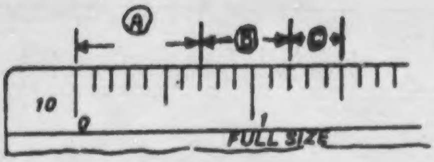
2. In the diagram, distance A is:



   - a. 1.65 inches.
   - b. 1 1/2 inches.
   - c. 2.5 inches.
   - d. 3 1/16 inches.

3. In the diagram, the 10 means:
   - a. 10 graduations to the inch.
   - b. 10 inches to the graduation.
   - c. a 10 to 1 scale.
   - d. the scale is 10 inches long.

4. In the diagram, the distance from 0 to 2 is:
   - a. 2 miles.
   - b. 2 inches.
   - c. 2 meters.
   - d. 2 feet.

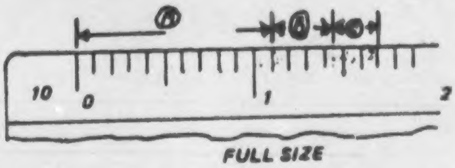

A
B
C
10
0
1
FULL SIZE

5. In the diagram, distance B is:

   a. .5 inch.
   b. 1.2 inches.
   c. 5/8 inch.
   d. .75 meters.

6. In the diagram, distance A plus distance B is:

   a. 1.2 inches.
   b. 1 meter.
   c. 1 inch.
   d. 1.2 meters.


A
B
C
10
0
1
2
FULL SIZE

7. In the diagram, distance A is:

   a. 1 1/8 inches.
   b. 1 1/8 meters.
   c. 1 1/10 inches.
   d. 1 1/10 meters.

8. In the diagram, distance C is:

   a. .37 inches.
   b. 1/4 inch.
   c. 25 meters.
   d. 1/8 inch.

9. In the diagram, distance A plus distance B is:

   a. 1.45 meters.
   b. 1.05 meters.
   c. 1.45 inches.
   d. 1.05 inches.

10. In the diagram, distance A plus distance C is:

   a. 1.35 inches.
   b. 1.35 meters.
   c. .65 inches.
   d. .65 meters.

LAP TEST ANSWER KEY: USING THE ENGINEER'S SCALE

1. D
2. A
3. A
4. B
5. A
6. A
7. C
8. B
9. C
10. A

Student: ______________________ File Code: 79.01.01.06 - .07.A2-2

Date: ______________________ Date Published: 10/7/77

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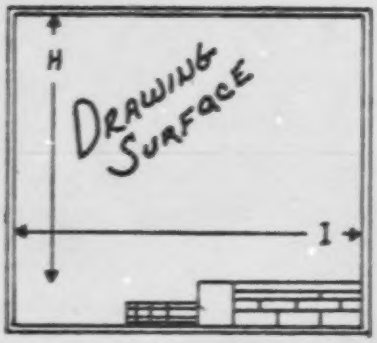
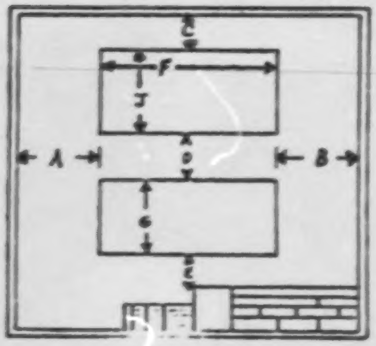
LAP TEST: CENTERING TWO-VIEW AND THREE-VIEW DRAWINGS





1. When centering a two-view drawing:

   a. distance A can be any length you decide.
   b. distance A never equals distance B.
   c. distance A always equals 2 inches.
   d. distance A always equals distance B.

2. When vertically centering a two-view drawing:

   a. distance D equals distance G.
   b. distance E equals distance A.
   c. distance C equals distance D and distance E.
   d. distance C equals distance E.

3. The formula for horizontal spacing is:

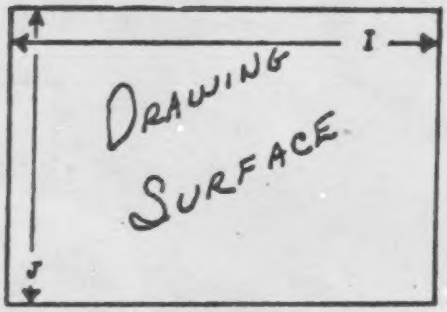
   a. I minus F divided by 2.
   b. I minus F divided by 3.
   c. C plus D plus E divided by 2.
   d. C plus D plus E divided by 3.

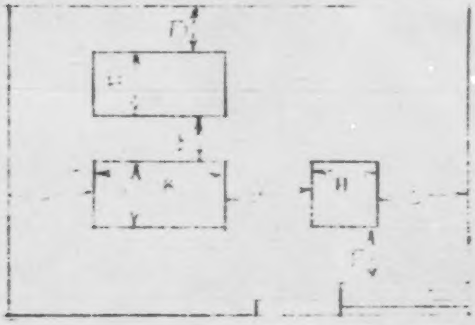
4. When spacing a two-view drawing the width of the top and front views is:

   a. different by 1 inch.
   b. the same.
   c. different by 2 inches.
   d. different by 3 inches.

5. When drawing a two-view drawing, the first step is to:

   a. determine the spacing between the views.
   b. draw horizontal construction lines.
   c. draw vertical construction lines.
   d. draw circles and arcs.





6. When centering a three-view drawing:

   a. distance A equals distance C and distance F.
   b. distance A, B and C are never equal.
   c. distance A equals distance B and distance F.
   d. distance A equals distance C.

7. The formula for vertical spacing is:

   a. J minus (G plus H) divded by 3.
   b. A plus B plus C divided by 3.
   c. A plus B plus C divded by 2.
   d. J minus (G plus E plus H) divded by 2.

8. When spacing a three-view drawing, the width of the top and front views are:

   a. different by 1 inch.
   b. the same.
   c. different by 2 inches.
   d. different by 3 inches.

9. The first step in drawing a three-view drawing is to:
   - a. draw circles and arcs.
   - b. draw horizontal lines.
   - c. draw vertical lines.
   - d. determine the spacing.

10. The formula for horizontal spacing is:
   - a. I minus (K plus B plus H) divided by 2.
   - b. I minus (A plus B plus C) divided by 2.
   - c. (A plus K plus B plus H plus C) divided by 3.
   - d. J minus (K plus H) divided by 3.

79.01.01.06.A2-2
79.01.01.07.A2-2

LAP TEST ANSWER KEY: CENTERING TWO-VIEW AND THREE-VIEW DRAWINGS

LAP		
06	1.	D
	2.	C
	3.	A
	4.	B
	5.	A
07	6.	D
	7.	D
	8.	B
	9.	D
	10.	A

Family Education Program

File Code: 79.01.01.08:A2-0

Date Published: 10-7-77

Revised: 8-14-79

Learning Activity Package

Student: ______________________

Date: ______________________

PERFORMANCE ACTIVITY: Inking Techniques Ruling Pen and Leroy Pens

OBJECTIVES:

Identify the mechanical pen and its parts and sizes. Become familiar with the use of the Leroy mechanical pen, templates and scriber. Identify the techniques for inking with the ruling pen.

EVALUATION PROCEDURE:

Successfully complete at least 80% of the items on a multiple-choice test over this LAP.

RESOURCES:

Basic Technical Drawing -- Chapter 8
Leroy lettering set instructions.

PROCEDURE:

1. Read the above Resource(s).
2. Learn the following pen sizes and functions as we apply them at FTC:

Pen #	Uses	Pen #	Uses
#00	Center, dimension, extension	#2	Lettering with template #140
#0	Hidden, section, threads	#5	Border
#1	Visible object lines		

3. Read information on using the Leroy Lettering Set.
4. The instructor will demonstrate how to disassemble, clean, fill, and use the mechanical pen when you begin LAP 79.01.02.03.
5. Read the following summary on ruling pens:
   a. Position of the ruling pen should be at the recommended angle.
   b. Correct use of drawing ink: A clogged pen often may be started by touching it to drafting tape or the back of the finger. Ink should never be allowed to dry in any instrument.
   c. Control of thickness of lines.

Factors that tend to make ruling pen lines heavier are:

1) Excess ink in the pen.
2) Dull nibs.
3) Slow movement of the pen.
4) Caked particles of ink on the nibs.
5) Leaning the pen more toward the paper.
6) Soft working surface.

Principal Author(s): C. Dvorak, S. Vosen, J. Wheatley

Factors that tend to make lines finer:

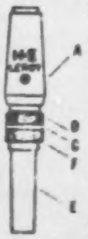
1) Small amount of ink in the pen.
2) Rapid movement of the pen.
3) Sharp nibs.
4) Fresh ink and a clean pen.
5) Pen more nearly vertical.
6) A hard working surface.

d. Always use a straight edge. Placing tape on underside of straight edge helps to prevent ink from running under the edge.
e. In inking or tracing a pencil line, the ink line should be centered over the pencil line.
f. Use bow pen for inking circles and arcs of less than 1" radius on all inked drawings. (Refer to p. 41, Figure 2.43, Technical Drawing).

NOTE: You will be evaluated on use of the ruling pen for borders and title blocks in the last LAP and Performance Test of Unit .03.

6. Take test over Part I and II of this LAP.

RESERVOIR PENS (61 0051) — Available in fourteen sizes from -0000 to -6, and -8, -10, -12, -14. They produce lines having the same width as the corresponding size LEROY Standard Pens.



TO FILL: Remove ink container. To do this, grasp the black pen body at (D). Unscrew and remove the knurled lock-ring (F). Remove ink container (E) from body. Spacer ring (G) should remain in place.

Use No. 58 0005 LEROY Lettering Ink Cartridge to fill container not more than ⅜" from top to allow for the end of the pen body. Insert pen body into container opening. Replace lock-ring and screw tightly in place on the pen body.

TO LETTER: Unscrew cap (A). Shake pen up and down until ink begins to flow. Clamp pen in scriber and letter same as with LEROY Standard Pens.

When pens are not in use they should be removed from the scriber, capped, and kept in a vertical position with the tip upward. If, after being stored for some time, the ink does not flow, start ink flow by shaking up and down.

The newly designed tapered cap has a unique sta-dri feature, which prevents ink from drying and clogging when not in use for extended periods of time.

If the flow of ink becomes sluggish or if the ink in the pen has been allowed to dry, the pen must be thoroughly cleaned.

TO USE AS RULING PEN: The pens easily screw into Holder No. 61 0055. When removing the holder, be sure that the knurled lock-ring (F) remains attached to spacer ring (G).

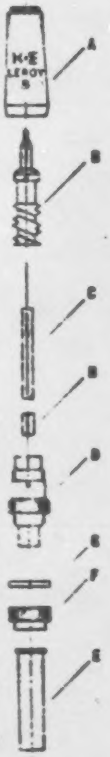
TO CLEAN: 1. Remove cap (A) and ink container (E).

2. Soak the body of the pen and ink container overnight in LEROY Pen Cleaning Fluid 61 3117. If faster action is desired, place parts in LEROY Ultrasonic Cleaner 61 3125.

3. After soaking, hold the knurled part (D) of the body with the tip downward, and unscrew the point section (B)* using the triangular-shaped nib key furnished with your set.

The end of the cleaning wire weight (C) will be seen protruding from the point section. If the weight cannot easily be removed do not force it out: Soak the point section in the cleaning fluid or place in LEROY Ultrasonic Cleaner 61 3125 until the weight becomes loose, then remove it. The weighted wire must be carefully handled at all times. Any damage to the wire will impair the operation of the pen.

4. Immerse all body parts in cleaning fluid and rinse with water. 5. Dry and reassemble.



**If point section cannot be easily unscrewed, do not force it. Return the complete pen to K&E Company, Morristown, New Jersey, or the nearest Branch for service.*

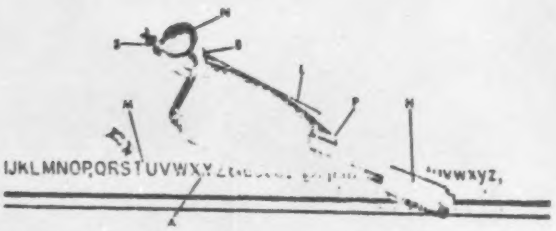
LEROY® Lettering Set

INSTRUCTIONS FOR LETTERING

1. Select Leroy Template with letter height you need. (The numbers 80, 100, 120, etc., indicate the height in thousandths of an inch.)
2. Lay template along a straightedge.
3. Select the Leroy Pen (Reservoir or Standard) and width of line you wish. The chart of pens and templates below will give you letters of the height indicated on the template.
4. Squeeze lever (L) with fingers, and insert pen in socket (S) at end of scriber arm until it is home to shoulder. Release pressure on lever to lock pen in place. Fill reservoir of Standard Pen with drawing ink. To fill Reservoir Pens, see instructions on reverse side.

For pencil lettering, clamp pencil 61 0198 (contains 12 prefilled leads) in scriber same way as for pen.

5. Set tail pin (H) of scriber in straight guide groove of template.
6. Set tracer pin (M) of scriber in groove of a character.
7. Lower pen gently to drawing surface.
8. Use adjusting screw (N) to lift pen tip just clear of surface, until you find the exact amount of clearance for ink to flow properly. (This will vary with the consistency of the ink and nature of the drawing surface.) Having found right adjustment, tighten lock nut (B).
9. Proceed with lettering by moving tracer pin (M) in grooves of characters, keeping tail pin (H) in straight groove. Spacing between letters is easily determined by eye.



The Fixed Scriber will produce vertical characters and the Adjustable Scriber slant characters from vertical to 22½° forward. To adjust for slanting letters, loosen screw (A) and move arm to position desired.

The scale along lower edge of templates aids in centering a line of lettering. Each space represents distance, center to center, between normal letters. Consider letter I and spaces between words each at half value.

When pen is filled with ink, do not turn scriber upside down. Unless in actual use, raise scriber arm with built-in stand, so as to keep pen tip clear of table. Do this by lifting lever (P) all the way up.

Ink should not be allowed to dry and clog in the pen. Pens should be cleaned after use with Leroy Pen Cleaning Fluid No. 61 3117 and rinsed with water. *For faster action, use Leroy Ultrasonic Cleaner 61 3125.* To clean Reservoir Pens, see reverse side.

KEUFFEL & ESSER CO.
MORRISTOWN, NEW JERSEY 07960

For Template Size —	50	60	80	100	120	140	175	200	240	290	350	425	500
Pen Size recommended —	0000	000	000	00	0	1	2	3	3	4	4	5	6

Line Width	|	|	|	|	|	|	|	▌	▌	█	█	█
	4X0	3X0	00	0	1	2	3	4	5	6	7	8

Student: ______________________ File Code: 79.01.01.08.A2-2

Date: ______________________ Date Published: 10/7/77

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LAP TEST: INKING TECHNIQUES

PART I – RULING PEN:

1. When drawing ink lines, the ruling pen should be:

   a. at an angle of 45 degrees to the paper in the direction of the line.
   b. at an angle of 60 degrees to the paper in the direction of the line.
   c. at an angle of 90 degrees to the paper in the direction of the line.
   d. at any angle that is comfortable.

2. Thicker ink lines are caused by several factors; which one below does not cause thick lines?

   a. slow pen movement.
   b. caked ink and a dirty pen.
   c. excess ink in the pen.
   d. narrow nibs width.

3. When inking, the proper order is:

   a. horizontal, curved, vertical & inclined.
   b. no special order.
   c. inclined, vertical, horizontal & curved.
   d. curved, horizontal, vertical & inclined.

4. When tracing a pencil line with ink, the proper method is:

   a. to place the pen nibs 1/8 from the line.
   b. to center the ink line over the pencil line.
   c. to have the ink line on the outside of the pencil line.
   d. to have the ink line on the inside of the pencil line.

5. Thin ink lines are caused by:

   a. all the below.
   b. rapid movement of the pen.
   c. hard working surface.
   d. sharp nibs.

PART II – AUTOMATIC RESERVOIR PEN:

6. The automatic reservoir pen has how many parts:

   a. 3
   b. 5
   c. 6
   d. 7

7. What size automatic reservoir pen is used for visible object lines:

   a. No. 00
   b. No. 0
   c. No. 1
   d. No. 2

8. When inking straight lines with an automatic reservoir pen, the proper order is:

   a. vertical, horizontal, inclined.
   b. horizontal, vertical, inclined.
   c. vertical, inclined, horizontal.
   d. inclined, vertical, horizontal.

9. When drawing lines, the automatic reservoir pen should be held:

   a. at 60 degrees from direction of travel.
   b. vertical to paper and 90 degrees from direction of travel.
   c. 60 degrees from paper and direction of travel.
   d. at 60 degrees from paper and 45 degrees from direction of travel.

10. When ink is used in an instrument, it should be:

    a. cleaned out frequently.
    b. allowed to dry before cleaning.
    c. cleaned out just before using.
    d. cleaned out with sandpaper.

LAP TEST ANSWER KEY: INKING TECHNIQUES

PART I 1. B
2. D
3. D
4. B
5. A

PART II 6. D
7. C
8. B
9. B
10. A

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File Code: 79.01.01.09. A1-0

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Learning Activity Package

Student: ____________________

Date: ____________________

PERFORMANCE ACTIVITY: PRECEDENCE OF LINES

OBJECTIVE:

Identify the precedence of lines when one or more lines cover each other.

EVALUATION PROCEDURE:

Successful completion of this LAP is determined by correctly answering 8 out of 10 items on a multiple-choice test that is combined with "Applying Basic Mechanical Drawing Techniques" LAP test and is taken after completing that LAP.

RESOURCES:

Technical Drawing, para. 5.31, pg. 147.
Basic Technical Drawing, para. 6.16, pg. 95.

PROCEDURE:

1. Read the above resource(s).

2. Read the following summary:

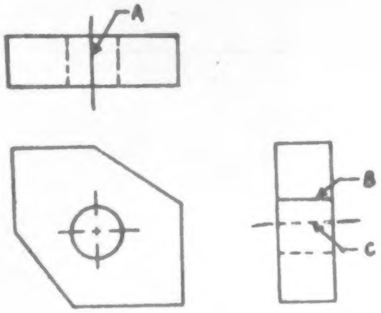
   a. A visible line always covers up a:

      (1) center line
      (2) hidden line

   b. Hidden lines cover up:

      (1) center lines

      NOTE: Visible lines covering center lines and hidden lines are shown at A and B, and a hidden line covering a center line at A and C. Visible or hidden lines covering center lines should extend approximately 1/4" outside the feature for which they are drawn.



Precedence of Lines

Principal Author(s): Charles Dvorak
Jere Wheatley
Sheila Vosen

File Code: 79.01.01.10:A2 0

Date Published: 10-7-77

Revised: 8-14-79

Family Education Program

Learning Activity Package

Student: ______________________

Date: ______________________

PERFORMANCE ACTIVITY: Applying Basic Mechanical Drawing Techniques

OBJECTIVE:

Line weight, line type and measurement are applied to drawing problems using appropriate drawing equipment in lead and ink.

EVALUATION PROCEDURE:

Drawing skills are evaluated on the unit performance test.

Successfully complete at least 80% of the items on a multiple-choice test about this LAP.

RESOURCES:

Basic Technical Drawing, Chapter 3, para. 3.13-3.16, page 28-30.
Technical Drawing, Chapter 2, pp. 46-50, 2.52-2.54.
Drafting Rules and Principles, Chapter 2, pp. 18-28, Fig. 6.

Basic drafting tools: (see Unit LEG)
Basic drafting furniture: (see Unit LEG)

PROCEDURE:

1. Read the above Resources.
2. Use Size "A" drawing paper for all of the drawings in this LAP.
3. Draw an 8½ by 11 rectangle on 3 sheets of paper, using construction lines inside this rectangle. Draw a 1/4" border and 1/2" title block as shown in Layout A-2 on the back inside cover of the Technical Drawing book.

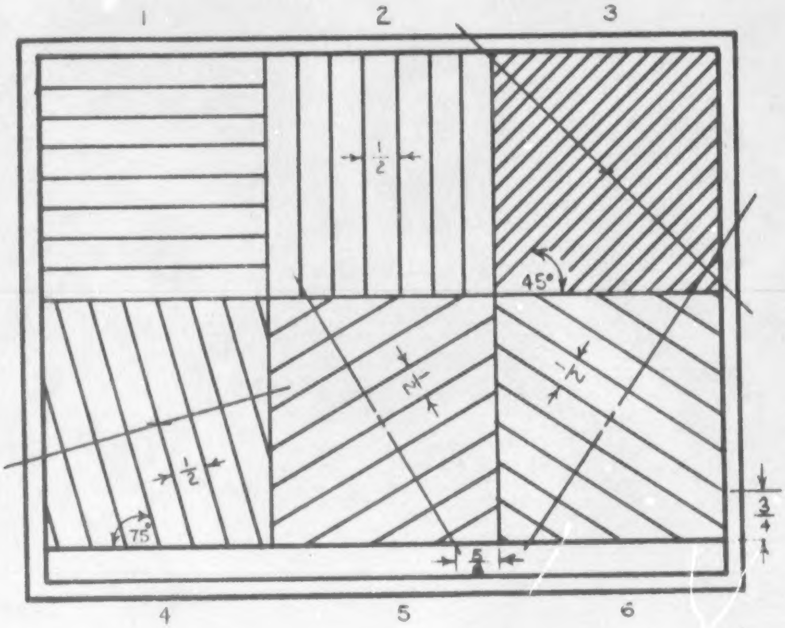
NOTE: Keeping Your Drawing Clean. Graphite filings from your lead and lines drawn on your paper, will work their way into your drawing surface as you move your T-square and triangles across the paper. Always remove filings from newly sharpened lead by wiping the point on a cloth or using the filter in your lead pointer. Periodically clean both sides of your T-square and triangles with a soft cloth. You may use a mild cleaning product. Sprinkling small amounts of erasure powder on your drawing will cause the T-square to roll the particles over the paper, thus collecting loose graphite. Dry, clean pads may be used to rub over drawing periodically, in order to collect graphite and remove light smudges. If you still have trouble with smearing, check your hands and make sure they are clean. You may want to place a clean sheet of paper over the parts of your drawing where you rest your hand or slide your T-square. Do not use your hand to brush away your erasure crumbs. Use your drafting brush.

Principal Author(s): C. Wetterling, S. Vosen, J. Wheatley

PROCEDURE (continued)

4. Follow the directions for each exercise shown below:

A.



1) After you have drawn your border and title block, determine your drawing space -- vertical and horizontal.

2) Divide this space into 6 equal rectangles. Use #2H lead to darken all visible lines.

RECTANGLE 1:

Use your bow dividers to divide the space into 8 equal horizontal spaces. Refer to the procedure described in your text book.

RECTANGLE 2:

Use your architect scale to mark off 1/2" vertical spaces, starting from the left side of the rectangle. Refer to 3.23 and Fig. 3-29, p. 36-37, Basic Technical Drawing. Note the correct method for taking measurements from your scale.

RECTANGLE 3:

Find the center of the rectangle (draw diagonals from corner to corner, the intersecting point is the middle). Draw a line at 45° through the center. Construct a light perpendicular to this line. Mark off points spaced 1/4" a part along the construction line, starting at the center. Draw visible lines through these points and parallel to the first visible line drawn.

RECTANGLE 4:

Follow same procedures for rectangle 3. Obtain a 75° angle by positioning your two triangles. Space visible lines 1/2" apart, starting at the center.

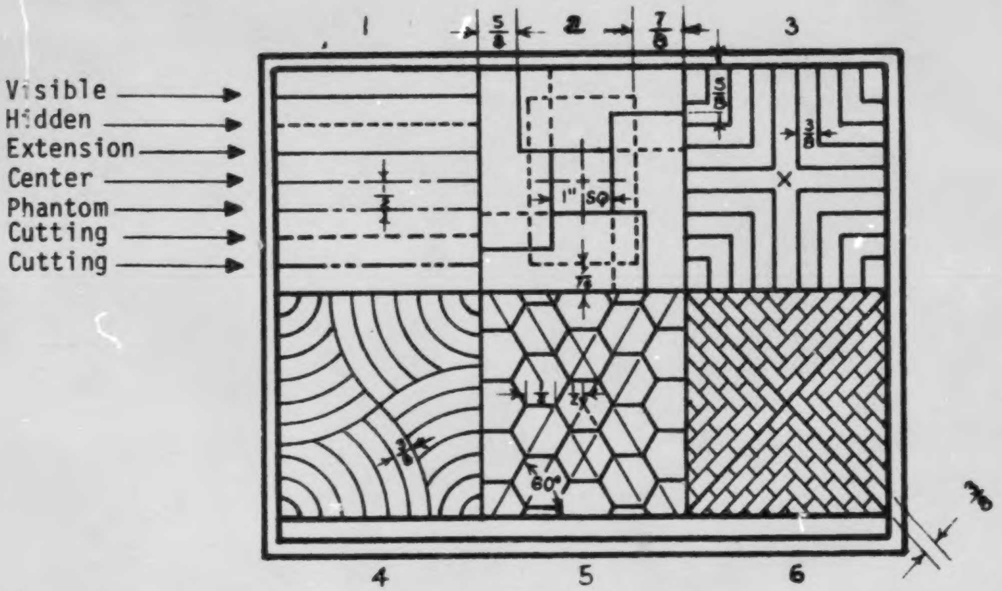
RECTANGLE 5:

Establish center point. Draw a construction line 5/8" from right edge and through the center. Draw visible line perpendicular to construction line and through center. Mark off 1/2" spaces along the construction line, starting at the center. Draw visible lines through these points and parallel to the first line.

RECTANGLE 6:

Establish center point. Draw visible line through center, starting 3/4" above right bottom corner, as shown. Construct a line perpendicular to the visible line. Mark off 1/2" spaces along construction line. Draw visible lines through these points and parallel to the first visible line.

B.



Divide workspace into 6 equal rectangles of 3½ x 3 3/4.

RECTANGLES 1 and 2:

Use appropriate leads to draw the various lines and indicate which leads were used.

Refer to page 21, Figure 6, Drafting Rules and Principles, for examples of hidden and visible line relationships.

RECTANGLES 3, 4, 5, and 6:

Determine a process and reproduce the drawings in each rectangle, based upon the information given in the above drawing.

C. Practice using your ruling pen and bow pen in the following exercise:

Part I:

1) Draw one rectangle using the dimensions in Exercise B.
2) Lightly construct the various lines indicated in rectangle 1 of Exercise B.
3) Practice using your ruling pen until you obtain an appropriate line weight for each line. (Refer to the "alphabet of lines", page 48, Technical Drawing.) Ask your

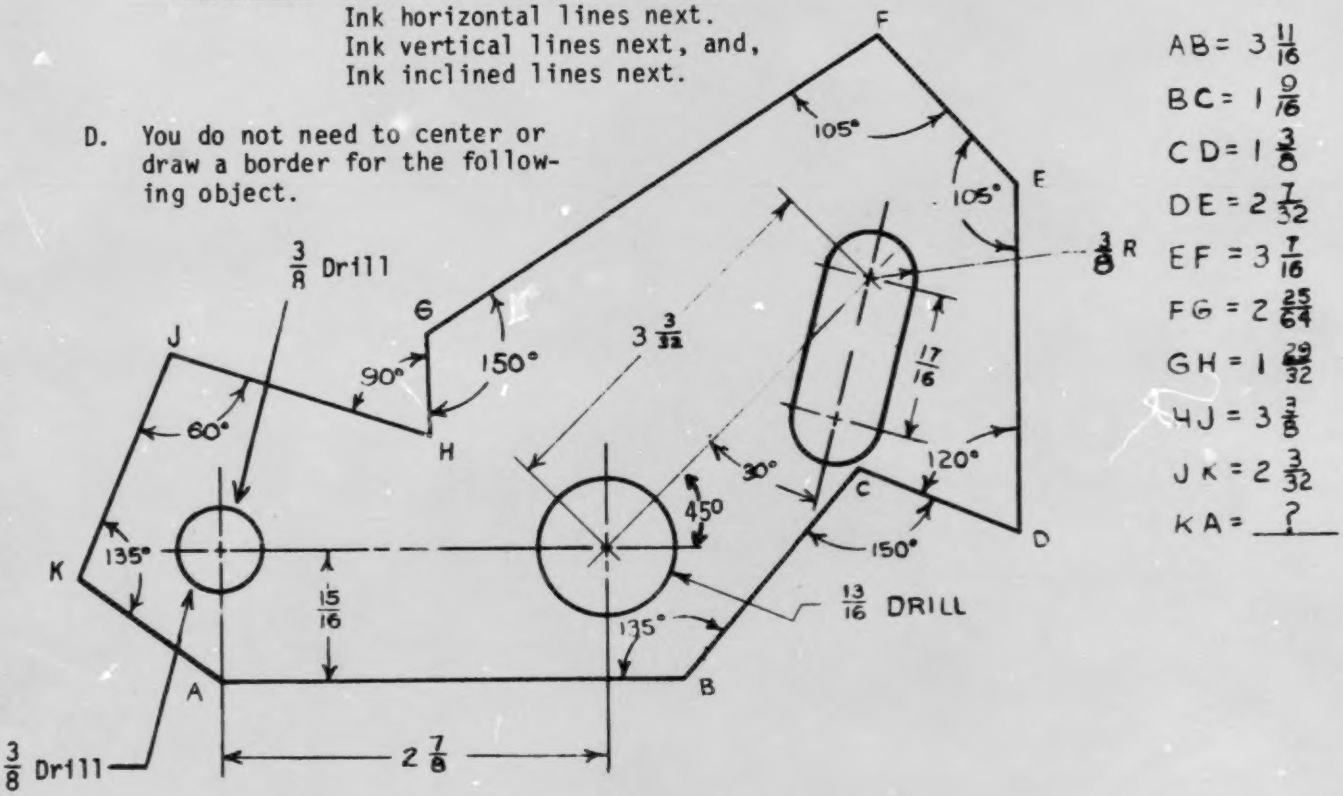
4) Ink over the construction lines, remembering to center the ink line over the lead line. (Refer to Figure 2.70, Technical Drawing.)

Part II:

1) On the same paper, construct a 6" x 4" rectangle.
2) Find the center point.
3) Use your compass to lightly construct a 7/8" diameter circle from this center point. Use 4-H or 6_H lead in your compass. You may sharpen your compass lead by placing it in your lead holder and using your lead pointer.
4) Construct a circle with a 1/4" radius, concentric to the first circle.
5) Measure in 5/16" from the right on the bottom horizontal line. Connect this point to the upper right hand corner with a light construction line.
6) Ink all lines using your ruling pen and bow compass. (Refer to 2.54, pp. 46-48, Technical Drawing.)

REMEMBER: Ink circles and arcs first.
Ink horizontal lines next.
Ink vertical lines next, and,
Ink inclined lines next.

D. You do not need to center or draw a border for the following object.


F
105°
105°
E
3/8 R
3/8 Drill
G
J
90°
150°
3 3/32
17/16
60°
H
30°
120°
C
45°
D
K
135°
15/16
150°
13/16 DRILL
135°
A
B
3/8 Drill
2 7/8
AB = 3 11/16
BC = 1 9/16
CD = 1 3/8
DE = 2 7/32
EF = 3 7/16
FG = 2 25/64
GH = 1 29/32
HJ = 3 3/8
JK = 2 3/32
KA = ?

Use triangles to arrive at the specified angles, as described on page 29, Basic Technical Drawing. DO NOT USE THE PROTRACTOR!

NOTE: Your drawing may not look exactly like the drawing in this LAP. Omit the dimensions and notes on your drawing.

1) When the drawings and answers to questions for Exercises A, B, C, and D meet your instructor's satisfaction, take the LAP test.
2) The performance test is located in the Performance Criterion File.

Student: ______________________ File Code: 79.01.01.09. - .10.A2-2

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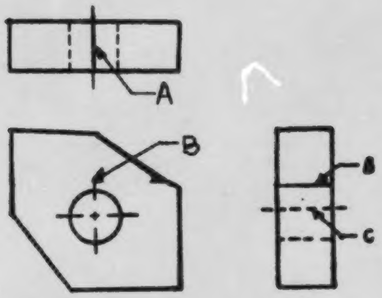
LAP TEST: PRECEDENCE OF LINES AND APPLYING BASIC MECHANICAL DRAWING TECHNIQUES



1. In the diagram, A shows:

   a. a hidden line behind a visible line.
   b. a visible line behind a center line.
   c. a visible line covering a center line.
   d. a hidden line covering a visible line.

2. In the diagram, C shows:

   a. a visible line covering a hidden line.
   b. a hidden line covering a center line.
   c. a hidden line covering a visible line.
   d. a visible line covering a center line.

3. In the diagram, A is a:

   a. center line.
   b. hidden line.
   c. visible line
   d. construction line.

4. In the diagram, C is a:

   a. visible line.
   b. center line.
   c. hidden line.
   d. construction line.

5. A visible line always takes precedence over a:

   a. center line or hidden line.
   b. circle or acre.
   c. border line.
   d. title block.

6. Objectives in drafting are:

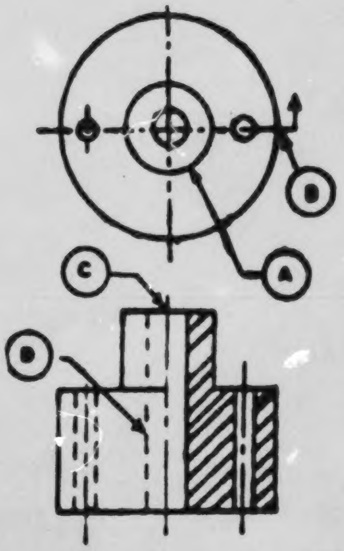
   a. accuracy, speed, legibility and neatness.
   b. equipment, instruments, books and pencils.
   c. reading, slow drawing, ink and text book.
   d. neat drawings, slow work and no accuracy.

7. The dash in hidden lines should be:

   a. 3/32 inch long.
   b. 1/4 inch long.
   c. 1/8 inch long.
   d. 1/2 inch long.

8. Line A in figure at right is:

   a. an outline.
   b. a solid line.
   c. a visible line.
   d. an exterior line.



9. To draw mechanical curves other than circles or circular arcs, use a:

   a. compass.
   b. electric eraser.
   c. drafting machine.
   d. french curve.

10. To save time when drawing symbols and repetitive features use:

   a. template.
   b. compasses.
   c. T-square and triangle.
   d. a drafting machine.

79.01.01.09.A2-2
79.01.01.10.A2-2

LAP TEST ANSWER KEY: PRECEDENCE OF LINES AND APPLYING BASIC MECHANICAL DRAWING TECHNIQUES

LAP		
09	1.	C
	2.	B
	3.	C
	4.	C
	5.	A
10	6	A
	7.	C
	8.	C
	9.	D
	10.	A

Student: ______________________ **File Code:** 79.01.01.00.A1-5

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Revised: 8-14-79

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UNIT PERFORMANCE TEST: MECHANICAL DRAWING

OBJECTIVE 1:

Given an illustration of a mechanical object, the student will be able to draw it using basic techniques of mechanical drawing.

OBJECTIVE 2:

The student will draw lines that are:

(a) Weighted to appropriate contrasts
(b) Neat
(c) Properly drawn

According to ASA Standards.

OBJECTIVE 3:

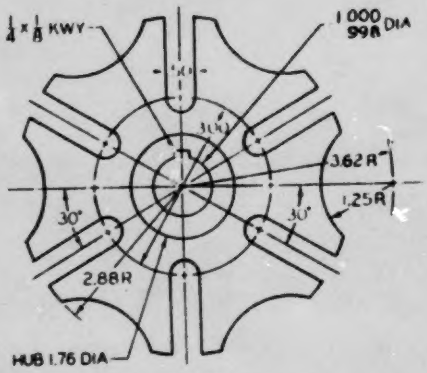
The student will be able to draw a drawing that is neat, accurate to given dimensions, and properly centered.

OBJECTIVE 4:

Student will complete the drawing in required time.

TASK:

The student will make a finished drawing of the given illustration, using the given dimensions.



Geneva Cam.

ASSIGNMENT:

1. Use size A paper.
2. Center object on paper. No border needed. Do not letter the dimensions.
3. Use proper lead and line weights for visible and center lines.
4. When drawing is completed and evaluated, take the Unit Test.

CONDITIONS:

The drawing is to be completed in a typical drafting room setting, using the Resources listed.

The student will not be able to use the instructor(s) or other students as a resource.

RESOURCES:

Drawing set
30 x 60 triangle.
45 x 45 triangle.
Architect's scale
Engineer scale
Brush
Lead holder
Lead pointer
Erasing shield
Drafting table
Drafting board
"T" square
Stool
Eraser
Leads (2H and 6H)
Tape
Drawing paper
Electric Eraser
Protractor
Technical Drawing, Giesecke/Mitchell/Spencer/Hill
Mechanical Drawing, French and Svenson
Engineering Drawing and Graphic Technology, French and Vierck

Student: ______________________ File Code: 79.01.01.00. A1-5

Date: ______________________ Date Published: 10/7/77

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PERFORMANCE CHECKLIST:

OVERALL PERFORMANCE: Satisfactory_____ Unsatisfactory_____

	CRITERION	
	Met	Not Met
Objective 1:		
1. Uses basic techniques.		
Criterion: No lines are missing from the drawing.		
Objective 2:		
2. Visible lines are neat and properly drawn.		
Criterion: (ASA Standards), Technical Drawing, p. 20.		
3. Center lines are neat and properly drawn.		
Criterion: (ASA Standards), Technical Drawing, p. 20.		
4. Visible lines are of appropriate contrast in relation. to the other lines.		
Criterion: (ASA Standards), Technical Drawing, p. 20.		
5. Center lines are of appropriate contrast in relation to the other lines.		
Criterion: (ASA Standards), Technical Drawing, p. 20.		

(Checklist continued)

	CRITERION	
	Met	Not Met
Objective 3:		
6. Drawing is clean and neat.		
Criterion: (ASA Standards), Technical Drawing, PP. 12-22.		
7. Drawing is centered.		
Criterion: (ASA Standards)		
8. Total drawing is accurately drawn to given dimensions.		
Criterion: plus or minus 1/32"; plus or minus 1°.		
9. The drawing is completed in the specified time limits		
Criterion: Not to exceed 5 hours.		
Student must meet criterion on 7 line items to obtain an		
overall score of satisfactory.		

Student: ______________________ **File Code:** 79.01.01.00.B2-2

Date: ______________________ **Date Published:** 6-18-74
Revised: 12-03-79

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UNIT POST TEST: MECHANICAL DRAWING

79.01.01.01

1. Soft leads are used:

   a. when extreme accuracy is required and for basic construction lines.
   b. only on soft paper.
   c. for art work but not for mechanical drawing.
   d. for general purpose work in mechanical drawing.

2. In our course, it is suggested you use which lead for object lines:

   a. H
   b. 2H
   c. 4H
   d. 6H

3. Lead weight, (hardness), is determined by:

   a. the color of lead.
   b. the size of lead.
   c. the amount of graphite in lead.
   d. the weight in ounces.

4. All lead is the same darkness, differences in line contrast are caused by:

   a. varying line width.
   b. pencil pressure.
   c. lead darkness.
   d. the type of line.

5. Construction lines should be made:

   a. thin, but light.
   b. wide, but dark.
   c. wide, but light.
   d. thin, but dark.

79.01.01.02

6. Left-handers should place the head of the T-square:

   a. on the right-hand side of the drawing board.
   b. on the bottom edge of the drawing board.
   c. on the left-hand side of the drawing board.
   d. on the top edge of the drawing board.

79.01.01.02 (continued)

7. When attaching paper to the drawing board, use:

   a. two fasteners.
   b. four fasteners.
   c. as many fasteners as you need.
   d. six fasteners.

8. Cellophane tape is:

   a. hard to remove and not recommended as a fastener.
   b. easy to remove from the paper.
   c. damaging to the board surface.
   d. the best fastener to use.

9. When mounting paper to the board, align the straightest edge of the paper to the:

   a. left edge of the board.
   b. top edge of the T-square.
   c. right edge of the triangle.
   d. bottom edge of the T-square.

10. The corner of the paper to attach to the board first is the (for right-handed people):

   a. bottom right.
   b. top right.
   c. bottom left.
   d. top left.

79.01.01.03

11. A horizontal line is drawn:

   a. from left to right if you are right handed.
   b. from right to left if you are right handed.
   c. from left to right if you are left handed.
   d. from left to right or right to left.

12. Horizontal lines are drawn:

   a. along the top of the T-square.
   b. along the bottom of the T-square.
   c. along the right of the T-square.
   d. along the left of the T-square.

13. A horizontal line drawn at the top of the paper should be ____________ to a horizontal line at the bottom of the paper.

   a. vertical.
   b. parallel.
   c. perpendicular.
   d. at an angle.

79.01.01.03 (continued)

14. The type of line drawn along the top of the T-square is:

    a. horizontal.
    b. vertical.
    c. curved.
    d. circles and arcs.

15. The T-square is held tightly against the board and the paper when:

    a. lettering freehanded.
    b. drawing circles and arcs.
    c. drawing with the french curve.
    d. drawing horizontal lines.

79.01.01.04

16. Vertical lines are drawn with the T-square and the:

    a. 45 degree triangle only.
    b. 45 degree or 30 degree x 60 degree triangle.
    c. 30 degree x 60 degree triangle only.
    d. french curve.

17. When drawing verticle lines, the head of the T-square is held:

    a. on the bottom of the board.
    b. on the top of the board.
    c. tightly against the working edge of the board.
    d. loosely.

18. When drawing vertical lines and the edge of the triangle is too sharp:

    a. throw it away.
    b. sand the edge lightly with #00 sandpaper.
    c. sharpen the pencil.
    d. don't draw the line.

19. The triangle is held tightly against the T-square, board and paper when:

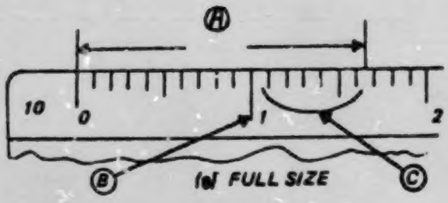
    a. lettering freehanded.
    b. drawing circles and arcs.
    c. drawing with the french curve.
    d. drawing vertical lines.

20. When drawing vertical lines, the trail of graphite particles are:

    a. left where they fall.
    b. rubbed into the paper.
    c. removed by eraser.
    d. blown off at intervals.

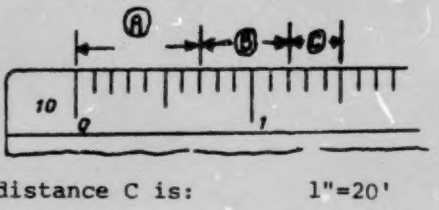
79.01.01.05

21. In the diagram, distance 0 to B is:



a. 1"
b. 10"
c. 1 1/16"
d. 1½"

22. In the diagram, distance A is:



a. 1.4"
b. 5/8 meters
c. 14'
d. .7"

23. In the diagram, distance C is:

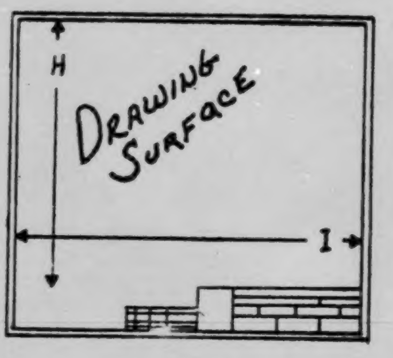
a. 1½'
b. 3/7"
c. 6'
d. 1/4 meters

24. In the diagram, distance B plus distance C is:

a. 1.6"
b. .8 meters
c. .8"
d. 16'

25. Given an engineers scale, using the 50 scale, each increment is:

a. 1/5 of an inch.
b. .5 of an inch.
c. 1/50 of an inch.
d. one inch.



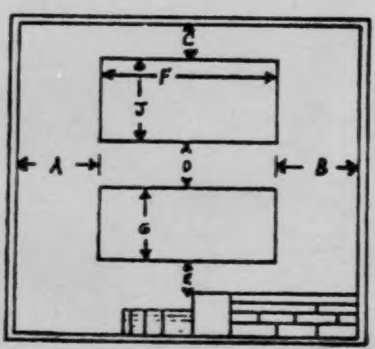
79.01.01.06

26. When centering a two view drawing:

a. distance B always equals distance C.
b. distance B always equals distance G.
c. distance B is always equal to distance A.
d. distance B can be any length you decide.

27. The formula for vertical spacing is:

a. A plus B divided by 2.
b. A plus B divided by 3.
c. H minus (J plus G) divided by 2.
d. H minus (J plus G) divided by 3.



79.01.01.06 (continued)

28. When drawing a two-view drawing, the first step is to:

a. determine the spacing between the views.
b. draw horizontal construction lines.
c. draw vertical construction lines.
d. draw circles and arcs.

29. On the two-view drawing, if I=16" and F=6", what is the space on each side of the object:

a. 8"
b. 3½"
c. 10"
d. 5"

30. On the two-view drawing, if H=8¼" and the height of the object was 1¼" and the depth of the object was 1", what would D equal?

a. 2"
b. 6"
c. 4"
d. 2 3/4"

79.01.01.07

31. When centering a three-view drawing:

a. distance A equals distance C and distance F.
b. distance A, B, and C are never equal.
c. distance A equals distance B and distance F.
d. distance E equals distance B.

32. When centering a three-view drawing:

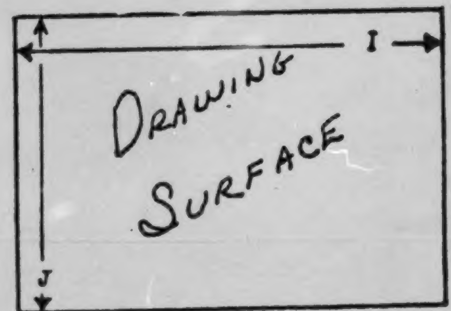
a. distance H and G are always equal.
b. distance D and G are always equal.
c. distances D and F are always equal.
d. distances A, F, and C are always equal.

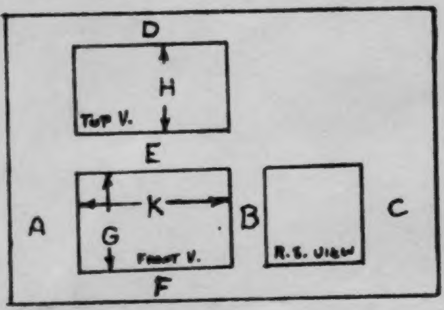
33. The formula for vertical spacing is:

a. J minus (G plus E plus H) divided by 2
b. A plus B plus C divided by 3.
c. A plus B plus C divided by 2.
d. J minus (G plus K) divided by 2.

34. The formula for horizontal spacing is:

a. A plus B plus C divided by 3.
b. I minus (2 times K) divided by 3.
c. A plus B plus C divided by 2.
d. I minus (K plus H plus B) divided by 2.





79.01.01.07 (continued)

35. The first step in making a three-view drawing is to:

    a. erase the construction lines.
    b. heavy-in all final lines
    c. locate the center line.
    d.

79.01.01.08

36. Thin ink lines are caused by:

    a. excess ink in the pen.
    b. rapid movement of the pen.
    c. dull nibs.
    d. slow movement of the pen.

37. When inking or tracing a pencil line, the ink line should be:

    a. above the pencil line.
    b. centered over the pencil line.
    c. below the pencil line.
    d. longer than the pencil line.

38. The first lines to ink on a drawing are:

    a. construction lines.
    b. hidden lines.
    c. circles and arcs.
    d. section lines.

39. Line weight with the LeRoy pens is controlled by:

    a. size of tip.
    b. amount of ink.
    c. darkness of line.
    d. type of line

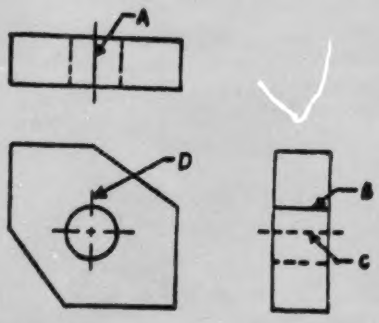
40. Which LeRoy pen will make the widest line:

    a. #000
    b. #3
    c. Arc type
    d. Ruling

79.01.01.09

41. In the diagram, B shows:

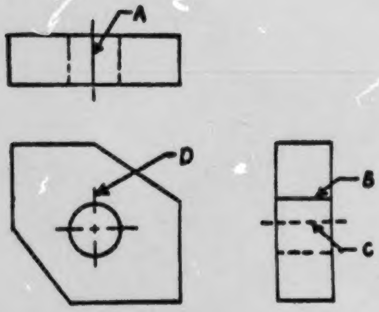
    a. a visible line covering a center line.
    b. a visible line behind a center line.
    c. a visible line behind a hidden line.
    d. a visible line covering a hidden line.



79.01.01.09 (continued)

42. In the diagram, A is a:

    a. center line.
    b. hidden line.
    c. visible line.
    d. construction line.



43. In the diagram, D is a:

    a. visible line.
    b. hidden line.
    c. construction line.
    d. center line.

44. In the diagram, B is a:

    a. center line.
    b. hidden line.
    c. visible line.
    d. construction line.

45. A hidden line always takes precedence over a:

    a. circle or arc.
    b. visible line.
    c. center line.
    d. border line.

79.01.01.10

46. Objectives in drafting are:

    a. accuracy, speed, legibility and neatness.
    b. equipment, instruments, books, and pencils.
    c. reading, slow drawing, ink, and text books.
    d. neat drawings, slow work. and no accuracy.

47. A pencil drawing, not for reproduction, is made on:

    a. polyester film.
    b. tracing cloth.
    c. tracing paper.
    d. drawing or detail paper.

48. To replace the T-square, triangles, scales, and protractor use a:

    a. parallel-ruling straightedge.
    b. template.
    c. drafting machine.
    d. mylar sheet.

79.01.01.10 (continued)

49. To draw mechanical curves other than circles or circular arcs, use a:

- a. compass.
- b. electric eraser.
- c. drafting machine.
- d. french curve.

50. For quick, repetitive work, use a(n):

- a. template
- b. scale
- c. scriber
- d. printer

79.01.01.00.B2-2
Date Revised: 12-03-79

UNIT POST TEST ANSWER KEY: MECHANICAL DRAWING

LAP 01:	1.	C
	2.	B
	3.	C
	4.	A
	5.	A
LAP 02:	6.	A
	7.	C
	8.	A
	9.	B
	10.	D
LAP 03:	11.	A
	12.	A
	13.	B
	14.	A
	15.	D
LAP 04:	16.	B
	17.	C
	18.	B
	19.	D
	20.	D
LAP 05:	21.	A
	22.	C
	23.	C
	24.	D
	25.	C
LAP 06:	26.	C
	27.	D
	28.	A
	29.	D
	30.	A
LAP 07:	31.	D
	32.	C
	33.	A
	34.	D
	35.	D
LAP 08:	36.	B
	37.	B
	38.	C
	39.	A
	40.	B
LAP 09:	41.	D
	42.	C
	43.	D
	44.	C
	45.	C
LAP 10:	46.	A
	47.	D
	48.	C
	49.	D
	50.	A

Family Education Program

File Code: 79.01.01.06

Date Published: 10/7/77

Revised: 8-14-79

Learning Activity Package

Student: ____________

Date: ____________

PERFORMANCE ACTIVITY: CENTERING TWO-VIEW DRAWINGS

OBJECTIVES:

I. Correctly identify the three basic dimensions used in multiview drawings based on drafting conventions.

II. Correctly determine the spacing for a two-view drawing, given surface size and object dimensions.

EVALUATION PROCEDURE:

Successful completion of this LAP is determined by correctly answering 8 out of 10 items on a multiple-choice test that is combined with 79.01.01.07 "Centering Three View-Drawings" LAP test, and is taken after completing that LAP.

RESOURCES:

Technical Drawing, pp. 138-139, 5.18-5.19.
Basic Technical Drawing, pp. 85-88 -- Fig. 6-4 and 6-8
pp. 108-109; 7.7

PROCEDURE:

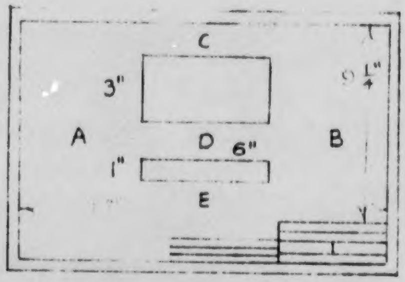
1. Read listed Resources for this LAP.
2. Label the 2 basic dimensions for each view of the object at the right.
3. Have your instructor check your answers.
4. These dimensions are terms which you will be using for size throughout the course.

Principal Author(s): Jere Wheatley, Sheila Vosen

Family Training Center, Inc.

NOTE: Determine the spacing of the views in relation to the drawing surface measured from the top line of the title block and exclusive of the border.

1. To determine horizontal spacing.
   a. Subtract the width of the object from the horizontal width of the drawing surface. In the example, the object width = 6", and the horizontal width = 17". Therefore: 17 - 6 = 11.



   b. The remainder (11) must then be divided by 2, since there is space on either side of the object, (A and B): 11 ÷ 2 = 5½" of space on each side of the object.

2. To determine vertical spacing:
   a. Add vertical dimensions of height and depth. The example shows 3" depth and 1" height: 3 + 1 = 4" total vertical object space.
   b. Subtract this total from the vertical drawing surface: 9¼" - 4 = 5¼".
   c. The remainder (5¼) must then be divided by 3, since there are 3 equal empty spaces on the vertical surface of the paper: 5¼ ÷ 3 = 1 3/4 (C = D = E).

3. Work through the example in Steps 1 and 2 until you fully understand the process and mathematics involved. Then go on to the problem in Step 4.

4. Do the following problem based on the information given below and the procedure explained in this LAP.

   GIVEN:

   Drawing surface dimensions: Horizontal = 17"
   Vertical = 9 1/4"

   Object size dimensions: Width = 9 3/4"
   Depth = 3 1/16"
   Height = 3 1/2"

   PROBLEM:

   The horiztonal spacing equals ______________________________

   The vertical spacing equals ______________________________

Check your answers with the instructor's key.

5. LAP test is combined with LAP .07.

File Code: 79.01.01.07.

Date Published: 10/7/77
Revised: 8-14-79

Family Education Program

Learning Activity Package

Student:

Date:

PERFORMANCE ACTIVITY: CENTERING THREE-VIEW DRAWINGS

OBJECTIVE:

Correctly determine spacing for centering a three-view drawing given surface and object dimensions.

EVALUATION PROCEDURE:

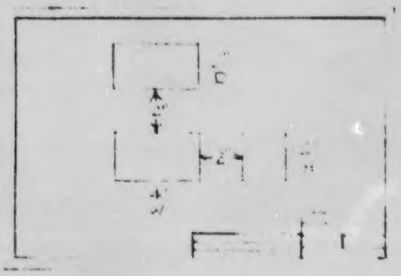
Successfully complete at least 80% of the items on a multiple-choice test about this LAP.

RESOURCES:

Basic Technical Drawing, 7.9, PP. 109-110.

PROCEDURE:

1. To find horizontal spacing.
   a. Add totals for horizontal dimensions for which width (W) and depth (D) would be 6" on the example shown.
   b. Arbitrarily determine spacing between 2 object views which is proportional to the object size and paper (For example 2").
   c. Add this to the W and D of the objects.
   d. Subtract this total from the horizontal surface dimension
   e. Divide the remainder by 2, for 2 equal spaces on the outside left and right margins.



HINT: Choosing an arbitrary space between objects is best determined by a feel for placing the objects at a distance from each other. This distance should both look good on the drawing surface, and accommodate dimensions between objects. You will learn to see these proportions with experience. If you have much trouble with determining spacing, sketch a basic block for each of the object views, cut these out and arrange them on your drawing surface until you arrive at a suitable spacing.

Principal Author(s): Sheila Vosen, Jere Wheatley

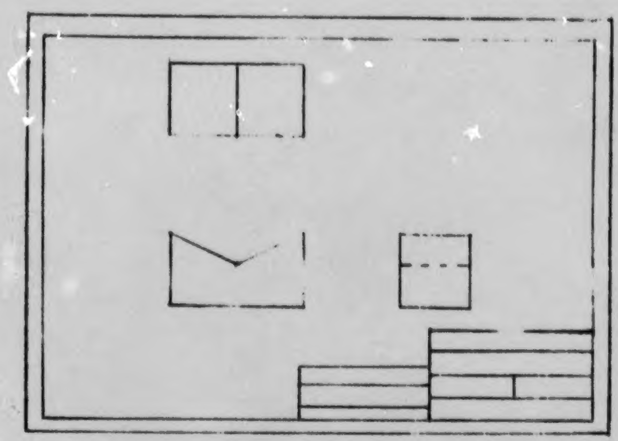
2. To determine vertical spacing.
    a. Add the height and depth dimension to the arbitrarily determined space.
    b. Subtract this number from the total vertical surface.
    c. Divide the remainder by 2. This will give the top and bottom margins.

NOTE: This is the procedure you will use to center your drawings using size B (12"x18") paper throughout this drafting course.

3. Problem: Determine the horizontal and vertical spacing for the following problem.

Drawing surface dimensions:
horizontal: 17"
vertical 9 1/4"

Object dimensions:
height: 1 3/4"
width: 3 1/4"
depth: 2 1/8"



Arbitrary Spacing = ______________________

Vertical spacing = ______________________

Horizontal spacing = ______________________

4. Check your answers with instructor(s) answer key.

5. Take the LAP test.

Family Education Program

File Code: 79.01.02.00:A2-1

Date Published: 10/17/75

Revised: 8-14-79

Learning Experience Guide

UNIT: LETTERING

RATIONALE:

In 1935, a standardized form of lettering was adopted by the United States American Standards Institute. This form of letter (U.S. Standard Letters) has become the accepted style of lettering for mechanical drafting. Other styles of lettering are used in other fields. The General Rule to follow is: use whatever style of lettering conforms to the job as long as it is legible and uniform.

PREREQUISITES:

Unit: 79.01.01 -- Mechanical Drawing

OBJECTIVES:

Letter to specifications, freehanded, using U.S. Standard Lettering Style.
Letter to specifications with the Ames Lettering guide using a developed free style..
Letter to specifications, mechanically, when using the Leroy lettering guide.

RESOURCES:

Printed Materials

Basic Technical Drawing, Spencer and Dygdon, Macmillan Company, New York.
Technical Drawing, Sixth Edition, Giesecke, Mitchell, Spencer and Hill, Macmillan Co.
Lessons in Lettering, Book 1, Third Edition. French and Turnbull, McGraw-Hill, N.Y.
Supplement on Lettering Styles, developed by Drafting class.

Audio/Visuals

Video Cassette on Ames and Leroy Guide.
Drafting Series. "Lettering", Doubleday Media.

Equipment

As given in Course LEG.

Principal Author(s): Sheila Vosen, Chuck Wetterling, Jere Wheatley

Family Training Center, Inc.

GENERAL INSTRUCTIONS:

This unit consists of three Learning Activity Packages (LAPs). Each LAP will provide specific information for completion of a learning activity.

The general procedure for this unit is as follows:

1) Read the first assigned LAP.
2) Begin and complete the first assigned LAP.
3) Take and score the LAP test.
4) Turn in the LAP test answer sheet.
5) Determine the reason for any missed items on the LAP test.
6) Proceed to, and complete, the next assigned LAP in the unit.
7) Complete all required LAPs for the unit by following steps 3 through 6.
8) In this unit, there are some LAPs that have tests combined with other LAP tests. These combined tests are taken after completing the last LAP covered by the test.
9) Take the unic tests as described in the Unit LEG "Evaluation Procedures".
10) Proceed to the next assigned unit.

PERFORMANCE ACTIVITIES:

.01 -- Freehand Lettering (U.S. Standard Style)
.02 -- Ames Lettering Instrument (Developed Free Style)
.03 -- Mechanical Lettering Instruments

EVALUATION PROCEDURE:

1. As the student completes each LAP, he/she will take the LAP test for the LAP.
2. The student takes a multiple-choice unit post test and a unit performance test.

   Successful unit completion is an 80% on LAP and Unit Tests and meeting the listed criteria for the performance test.

FOLLOW-THROUGH:

The skills of lettering attained in this Unit shall be one of the basis for evaluating future drawings.

Print your name and address neatly on a sheet of paper using guide lines for a height of 1/8".

Go to the first assigned Learning Activity Package (LAP) listed on your Student Progress Record (SPR).

Student: ______________________ File Code: 79.01.02.00. A2-2

Date: ______________________ Date Published: 6/19/74

Mountain-Plains Education &
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UNIT PRETEST: LETTERING

79.01.02.01.

1. The American Standards call for:

   a. vertical or inclined lettering.
   b. inclined lettering only.
   c. vertical lettering only.
   d. a mixture of vertical and inclined lettering.

2. The general rule for spacing letters within a word is:

   a. the distance between letters should be equal.
   b. the distance between letters should be as large as a zero.
   c. the area between letters should cover about one-fourth as much area as the preceding letter.
   d. the areas between letters should be about equal.

3. Pencil lettering should appear:

   a. dense black.
   b. dull grey.
   c. with different thicknesses of lines.
   d. with the same measurement between letters.

4. Lettering on drawings should be underlined:

   a. never.
   b. when special emphasis is required.
   c. when it is for a dimension.
   d. only in the title.

5. Inclined lettering is drawn in strokes that follow the order and direction:

   a. that is comfortable for you.
   b. that is unique for inclined lettering.
   c. of vertical lettering.
   d. of all horizontal strokes first, then the vertical.

79.01.02.02.

6. The Ames lettering instrument is used:

   a. with an ink pen.
   b. with a 60 degree triangle.
   c. with a T-square.
   d. with a protractor.

7. The slanted side of the Ames lettering guide is used for:

   a. cleaning a pencil.
   b. drawing vertical guide lines.
   c. drawing horizontal guide lines.
   d. drawing slant guide lines.

79.01.02.03.

8. The Leroy set is used with:

   a. the ruling pen.
   b. standard pen reservoir pen, or "020" pencil.
   c. the standard mechanical pencil.
   d. a separate piece of pencil lead.

9. With the Leroy, the guide pin follows:

   a. the edge of the T-square.
   b. grooved letters in a template.
   c. a 45 degree line.
   d. a 60 degree line.

10. The Leroy pen is constructed of:

   a. three pieces.
   b. one piece.
   c. two pieces.
   d. four pieces.

UNIT PRETEST ANSWER KEY: LETTERING

LAP	
01	1. A
	2. D
	3. A
	4. B
	5. C
02	6. C
	7. D
03	8. B
	9. B
	10. C

File Code: 79.01.02.01.A2-0

Date Published: 12/7/77

Revised: 8-14-79

Mountain-Plains Education & Economic Development Program, Inc.
Glasgow AFB, Montana 59231

Learning Activity Package

Student: ______________________

Date: ______________________

PERFORMANCE ACTIVITY: Freehand Lettering (Using U.S. Standard Style)

OBJECTIVE:

Letter, freehanded, various letters, words and numbers using the accepted U.S. Standard Style.

EVALUATION PROCEDURE:

Instructor will examine lettering for neatness, spacing accuracy and linework. A maximum of five errors per assignment sheet will be allowed.

A score of 80% is needed for successful completion of the LAP test.

RESOURCES:

Lessons in Lettering, Book 1.
Basic Technical Drawing, Chapter 4.
Attached assignment sheets
Filmstrip: Lettering

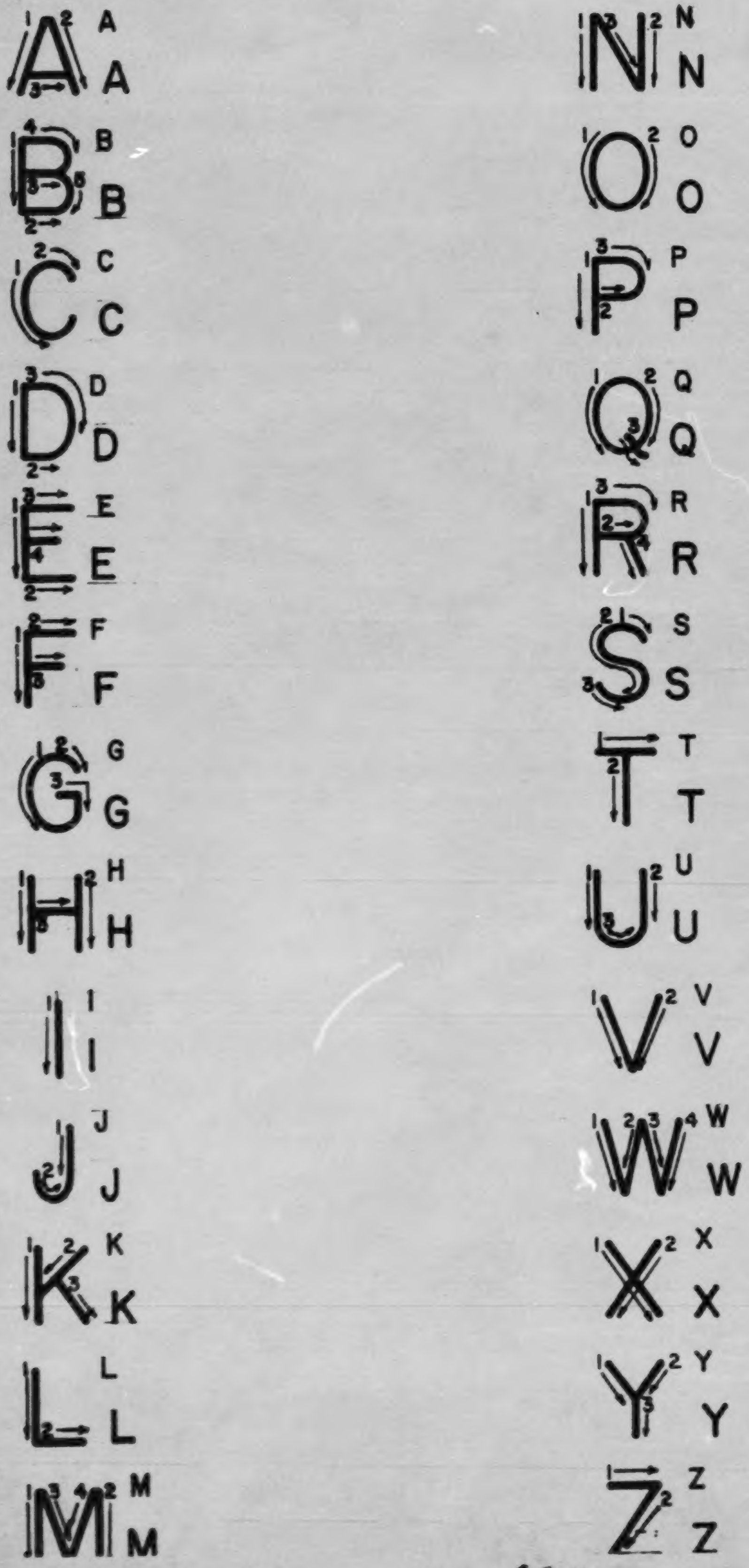
PROCEDURE:

Steps

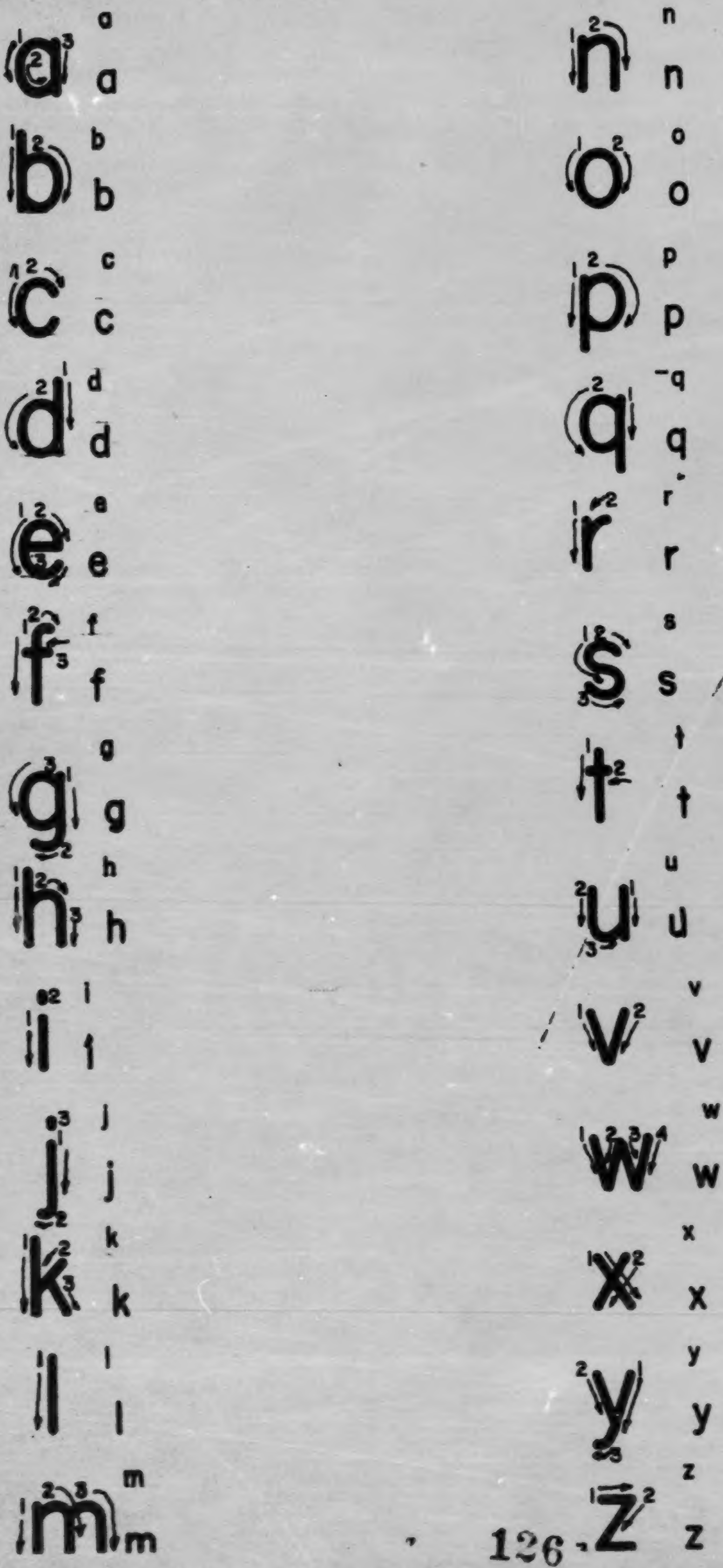
1. Read the above resource(s).
2. View the filmstrip on "Lettering" and the video cassette.
3. Letter, freehanded, the various letters, words and numbers on assignment sheets. Do all lettering on the assignment sheet in U.S. Standard Style.
4. Turn in completed sheets to instructor for evaluation.
5. Take the LAP test and proceed to the next LAP, upon successful completion of this material.

Principal Author(s): Q. Fogleman, S. Vosen, J. Wheatley

Letter the following examples using the guide lines given. Use 1/8 inch letters and 1/4 inch letters.


A A
B B
C C
D D
E E
F F
G G
H H
I I
J J
K K
L L
M M
N N
O O
P P
Q Q
R R
S S
T T
U U
V V
W W
X X
Y Y
Z Z

Letter the following using 1/8" and 1/4" letters. Always use both horizontal and vertical guide lines.


a a a
b b b
c c c
d d d
e e e
f f f
g g g
h h h
i i i
j j j
k k k
l l l
m m m
n n n
o o o
p p p
q q q
r r r
s s s
t t t
u u u
v v v
w w w
x x x
y y y
z z z

Letter the following sentences using the given guide lines.

GOOD LETTERING IS NOT THE RESULT OF AN IN-BORN TALENT, BUT IS DEVELOPED THRU CONSTANT PRACTICE.

1/8 inch

G

1/4 inch

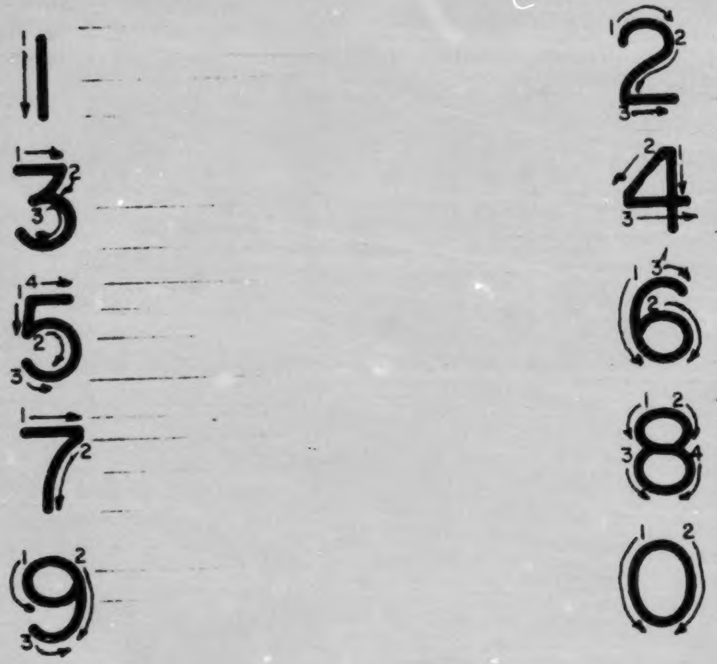
G

LETTERS MAY BE CONDENSED OR EXPANDED. Letter the above sentence in the spaces below.

L

L

Letter the following in the guide lines provided. Part of the exercise is ¼" lettering and part is 1/8" lettering.



$1\frac{9}{16}$ $2\frac{7}{8}$ $5\frac{1}{2}$ $7\frac{3}{4}$ $8\frac{7}{8}$

$1\frac{9}{16}$

4 5/32 6 1/2 4' 13.4" 23.6 cm. 35 in.

4

32' x 20' = 640 sq. ft. $2\frac{1}{2}'' + 4\frac{1}{4}'' = 6\frac{3}{4}''$ 7.6 meters

32'

Student: ______________________ File Code: 79.01.02.01.A2-2

Date: ______________________ Date Published: 6-19-74

Revised: 6-29-78

Mountain-Plains Education &
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LAP TEST: FREEHAND LETTERING

1. Pencil lettering should be done with:

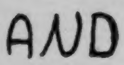
   a. 6H or 8H lead.
   b. 2B or 4B lead.
   c. F or H lead.
   d. any size ink pen.

2. On working drawings, capital letters are usually:

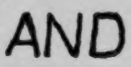
   a. 1 meter high.
   b. 1 inch high.
   c. 1/2 inch high.
   d. 1/8 inch high.

3. American Standard lettering looks like:

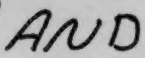
A)



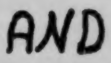
B)



c)



D)



4. The relationship of lower case letters to upper case letters should be:

   a. The width plus the height.
   b. Half the size.
   c. A ratio of 2 to 7.
   d. A ratio of 3 to 5.

5. The space between words should be about as large as the letter:

   a. U
   b. W
   c. B
   d. O

6. Pencil lettering should appear:

   a. dense black.
   b. dull grey.
   c. with different thicknesses of lines.
   d. with the same measurement between letters.

7. Lettering on drawings should be underlined:

   a. never.
   b. when special emphasis is required.
   c. when it is for a dimension.
   d. only in the title block.

8. Inclined lettering is drawn in strokes that follow the order and direction:

   a. that is comfortable for you.
   b. that is unique for inclined lettering.
   c. of vertical lettering.
   d. of all horizontal strokes first, then the vertical.

9. The height of whole numbers should be:

   a. 1/2 inch.
   b. 1/4 inch.
   c. 1/8 inch.
   d. 3/4 inch.

10. The height of fractions using 1/8 numbers should be:

    a. 3/4 inch.
    b. 1/8 inch.
    c. 1/2 inch.
    d. 1/4 inch.

LAP TEST ANSWER KEY: FREEHAND LETTERING

1. C
2. D
3. B
4. C
5. D
6. A
7. B
8. C
9. C
10. D

Family Education Program

File Code: 79.01.02.02:A2-0

Date Published: 12/7/77

Revised: 8-14-79

Learning Activity Package

Student: ______________________

Date: ______________________

PERFORMANCE ACTIVITY: Ames Lettering Instrument

OBJECTIVE:

Correctly use an Ames lettering guide.

EVALUATION PROCEDURE:

Instructor will examine work for neatness of lettering and correct usage of the Ames lettering guide. No more than three errors will be allowed.

Successful completion of this LAP is determined by correctly answering 8 out of 10 items on a multiple-choice test that is combined with "Mechanical Lettering Instruments" LAP test and is taken after completing that LAP.

RESOURCES:

Technical Drawing, page 72 (paragraph 3.17).

Ames Lettering Guide Instruction.

Supplement on Lettering Styles.

Video Cassette on use of Ames Guide.

PROCEDURE:

1. Read the above resource(s). Ask the instructor for a copy of the handout on lettering styles.
2. Using the Ames lettering guide, letter the entire alphabet in upper case first in 1/4" letters and then in 1/8" letters using your own individual style.
3. Have the work evaluated.
4. Using the Ames lettering guide, letter the entire Evaluation Procedure above first in 1/4" upper case letters and then 1/8" upper case letters using your own individual style of lettering.
5. Have the work evaluated.

Principal Author(s): Q. Fogleman, S. Vosen, J. Wheatley

HOW TO USE THE AMES LETTERING GUIDE

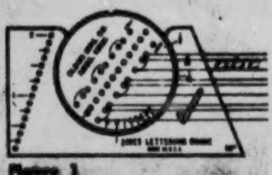


Figure 1

With your Ames Lettering Guide it is possible to draw guide lines and slope lines for lettering and numbering from 1/16 to 2 inches in height.

The numbers on the disc from 10 through 2 denote the height of letters in thirty-seconds of an inch. Assume you want letters 1/4 inch high. Rotate the disc so the 8 is at the frame index. See Figure 1.

To turn the disc clockwise, hold the frame at the upper lefthand corner with the left hand. Rotate the disc with the right hand. To turn the disc counter-clockwise, use the reverse procedure.

Use a 4H or harder drawing pencil sharpened to a conical point. With your tee square or straight-edge in the drafting position, place the base of the guide, readable side up, against the top edge of the straight-edge.

RIGHT-HAND COLUMN OF HOLES: In the column of holes marked 2/3, the body of the lower case letters will be 2/3 that of the capital letters. This ratio is the Reinhardt System.

Place the pencil in the second hole from the top. Keep the pencil in a plane that is perpendicular to the paper, but inclined slightly in the direction that you are drawing lines.

With the pencil, slide the guide to the right keeping the base in contact with the tee square until you have reached the terminal point, drawing the line lightly. Upon completion of the first line, move the pencil down hole by hole, repeating the procedure and drawing alternately to the left and then to the right.

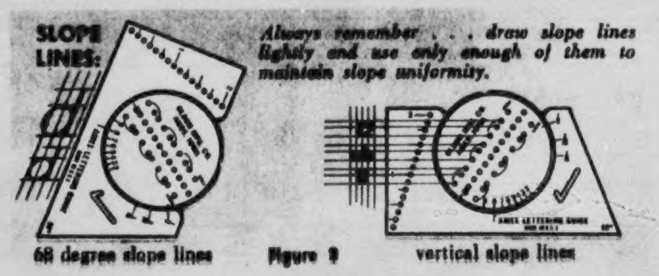
You now have one set of three guide lines 1/4 inch high. To draw two more sets, repeat the procedure using the rest of the holes in the 2/3 column. See the right side of Fig. 1. Note that the three sets of three holes are grouped by the elliptical lines, not only in the 2/3 column but the 3/5 as well.

DRAWING MORE THAN THREE SETS OF GUIDE LINES: Move the tee square and guide down until the top hole in the 2/3 column coincides with the bottom line of the last set of guide lines drawn before shifting the guide. Do not use this top hole. It is there only to give proper spacing between lines when the guide must be moved. Now place the pencil in the second hole and draw lines as before.

LEFT-HAND COLUMN OF HOLES: In the 3/5 column, the body of lower case letters will be 3/5 that of capitals. This ratio is usually used by Civil Engineers. To use this column, proceed identically as above.

SLOPE LINES:

Always remember . . . draw slope lines lightly and use only enough of them to maintain slope uniformity.



68 degree slope lines **Figure 2** vertical slope lines

CENTER COLUMN OF HOLES: The middle line in each set of 3 guide lines helps in upper-case letters such as B, E, F, H, etc. You will soon discover the center column to be a most versatile set of holes, with many other uses such as:

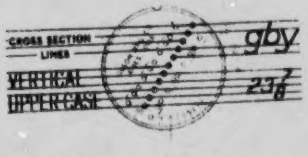


Figure 3

Cross-Sectioning: For 1/8" spacing, set the index mark on the disc (near the 2/3 fraction) at the 1/8 mark on the frame; for 3/32 or 1/16", set the disc at the corresponding marks on the frame. Set the edge of your straight edge parallel to the desired lines and proceed as shown in the upper left-hand corner of Fig. 3.

Numbers and Fractions: See the lower right side of Fig. 3 for size of fractions in relation to whole numbers.

Four Guide Lines: To assist beginning draftsmen with lower-case letters such as g, j, p, q, and y, it is helpful to use a 4th guide line. Use the top hole, 2nd, 4th, and 5th holes. See the upper right side of Fig. 3. If two sets are desired, go to the 7th, 8th, 10th, and bottom holes.

Misc. Applications: Many are possible such as the music staff, etc.

Block Letters: Several examples are shown at the right side of Fig. 4.

Guide Lines up to 1½ Inches in Height: Construct parallel lines at the desired height, using the top and bottom holes in the center column. For the 3/5 ratio drop 4 spaces to the 5th hole and draw the third guide line. With 11 holes and thus 10 spaces, this will give the 2/5 - 3/5 ratio. See the left side of Fig. 4 for an illustration of 1¼ inch guide lines.

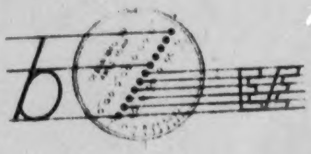


Figure 4

If the 1/3 - 2/3 ratio is desired, use the same procedure but drop only 3 spaces to the 4th hole for the third guide line.

USES OF 1/8 INCH SPACED HOLES UP LEFT-HAND SIDE OF THE FRAME: This set of holes has many possibilities such as title blocks and grid lines in multiples of 1/8 inch; section lining and dimension line spacing, and spacing from 0 to 2" as well as guide lines for letters and numbers up to 2 inches.

USES OF SYMBOL ON RIGHT-HAND SIDE OF FRAME: This is provided for such well-known uses as to indicate surface quality, the American Standard 60 degree refinish mark, and a short leader &/or weld symbol.

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Learning Activity Package

Student: ________________

Date: ________________

PERFORMANCE ACTIVITY: Mechanical Lettering Instruments

OBJECTIVE:

Letter in ink using a Leroy lettering instrument.

EVALUATION PROCEDURE:

Instructor will examine lettering for neatness, spacing, accuracy and linework. No errors will be allowed in the lettering.

Successfully complete at least 80% of the items on a multiple-choice test about this LAP.

RESOURCES:

Technical Drawing, pages 78-80 (paragraph 3.25).
Pamphlet on Leroy Equipment
Video cassette on use of Leroy Guide.

PROCEDURE:

NOTE: Before beginning: 1) Make sure the instructor has shown you how to take your pens apart and properly clean them. 2) Have your instructor show you how to use the guide for letter spacing and line spacing.

1. Read the resource(s) for use of the Leroy lettering instrument.
2. Letter, in ink, the entire alphabet in upper case and lower case letters and the numbers. Use a Leroy lettering instrument, guide no. 140-C, pen no. 1.
3. Letter the paragraph above (step 2) in four lines using upper case letters. KEY POINT: Size of templates is in thousandths of an inch (i.e., 140-C = .14" in height).
4. Have the work evaluated.
5. When satisfactory, take the LAP test.

Principal Author(s): C. Wetterling, J. Wheatley, S. Vosen

Student: ______________________ File Code: 79.01.02.02.-.03A2-2

Date: ______________________ Date Published: 6/19/74

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LAP TEST: AMES LETTERING INSTRUMENT/ MECHANICAL LETTERING INSTRUMENTS

1. The numbers on the bottom of the disc in the Ames instrument indicate:

   a. the number of letters to the inch.
   b. the heights of letters in thirty-seconds of an inch.
   c. the angle to use for slant lettering.
   d. the fractions that can be drawn.

2. The Ames lettering instrument is used to:

   a. draw capital letters.
   b. draw small letters.
   c. draw guide lines.
   d. draw numbers.

3. The Ames lettering instrument is used:

   a. with an ink pen.
   b. with a 60 degree triangle.
   c. with a T-square.
   d. with a protractor.

4. The slanted side of the Ames lettering guide is used for:

   a. cleaning a pencil.
   b. drawing vertical guide lines.
   c. drawing horizontal guide lines.
   d. drawing slant guide lines.

5. The most widely used mechanical lettering instrument is the:

   a. Varigraph.
   b. Wrico Pen and Guide.
   c. Letterguide Scriber.
   d. Leroy.

6. The numbers on the Leroy template(80,100,120,etc.) indicate:

   a. the letter height in thousandths of an inch.
   b. the number of letters to the inch.
   c. the recommended pen size.
   d. the letter height in thirty-seconds of an inch.

7. The numbers on the Leroy template (00,0,1,2,etc.) indicate:

   a. the number of letters to the inch.
   b. the recommended pen size.
   c. the letter height in thousandths of an inch.
   d. the letter height in thirty-seconds of an inch.

8. The Leroy set is used with:

   a. the ruling pen.
   b. standard pen, reservoir pen, or "020" pencil.
   c. the standard mechanical pencil.
   d. a separate piece of pencil lead.

9. When using the Leroy, the template is placed:

   a. along a french curve.
   b. along a straight edge.
   c. on top of the scriber.
   d. on top of the varigraph.

10. With the Leroy, the guide pin follows:

   a. the edge of the T-square.
   b. grooved letters in a template.
   c. a 45 degree line.
   d. a 60 degree line.

79.01.02.02. A2-2
79.01.02.03. A2-2

LAP TEST ANSWER KEY: AMES LETTERING INSTRUMENT/ MECHANICAL LETTERING INSTRUMENTS

LAP		
02	1.	B
	2.	C
	3.	C
	4.	D
03	5.	D
	6.	A
	7.	B
	8.	B
	9.	B
	10.	B

Student: ____________________ File Code: 79.01.02.00 A1 5

Date: ____________________ Date Published: 11-5-74

Revised: 8-14-79

Family Education Program

UNIT PERFORMANCE TEST: LETTERING

LE

OBJECTIVE 1:

Given a paragraph, the student will freehand print it, using U.S. Standard Style, one time using 1/8" high letters, and a second time using 1/4" high lettering.

OBJECTIVE 2:

Given a paragraph, the student will freehand letter it, using developed individual style, once using 1/8" letters and a second time using 1/4" letters.

OBJECTIVE 3:

Given a paragraph, the student will ink it, using the Leroy equipment, #140 guide and the appropriate pen for that guide.

TASK:

The student will freehand print the assigned paragraph, in U.S. Standard Style, once using 1/8" high lettering, and once using 1/4" high lettering.

The same paragraph will be lettered using individual style in 1/8" and 1/4" lettering.

Also, the same paragraph will be printed using the #140 Leroy guide and the appropriate pen.

ASSIGNMENT:

Use all upper case letters:

> "Although men have not been able to get together on a world language of words and sentences, there has actually been a universal language in use since the earliest times; the graphic language."

CONDITIONS:

The drawing is to be completed in a typical drafting room setting, using the equipment listed on the unit LEG.

The student will not be able to use the instructor(s) or other students as a resource.

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Student: ______________________ File Code: 79.01.02.00.A1-5

Date: ______________________ Date Published: 11/6/74

Revised: 8-14-79

Family Pay Number: __________ Sex: M F (Circle 1)

PERFORMANCE CHECKLIST:

OVERALL PERFORMANCE: Satisfactory_____ Unsatisfactory_____

	CRITERION	
	Met	Not Met
Objective 1:		
1. 1/8" lettering is neat and legible		
Criterion: (ASA Standards), Technical Drawing, p. 64		
2. 1/8" lettering has uniform spacing		
Criterion: (ASA Standards), Technical Drawing, p. 65		
3. 1/8" lettering has uniform height		
Criterion: (ASA Standards), Technical Drawing, p. 65		
4. 1/8" letters are of uniform inclination or are uniformly vertical		
Criterion: (ASA Standards), Technical Drawing, p. 65		
5. 1/4" lettering is neat and legible		
Criterion: (ASA Standards), Technical Drawing, p. 64		
6. 1/4" lettering has uniform spacing		
Criterion: (ASA Standards), Technical Drawing, p. 65		

	CRITERION	
	Met	Not Met
7. 1/4" lettering has uniform height		
Criterion: (ASA Standards), Technical Drawing, p. 65		
8. 1/4" letters are of uniform inclination or are uniformly vertical		
Criterion: (ASA STandards), Technical Drawing, p. 65		
Objective 2:		
9. Leroy lettering is neat		
Criterion: All letters consistent with the lettering guide, and no unnecessary lines. Technical Drawing, Giesecke, p. 80		
10. All Leroy letters are of uniform weight.		
Criterion: No irregular line weights		
11. Proper spacing is used between all words and lines.		
Criterion: (ASA Standards), Technical Drawing, Giesecke, pp. 79-81		
12. All words are correctly spelled in all exercises.		
Criterion: Spelled exactly as given in the assigned task		
13. The drawing is completed in specified time limits		
Criterion: Not to exceed 1-1/2 hours		
The student must meet criterion on 10 line items to obtain an overall score of satisfactory.		

Student: ______________________ File Code: 79.01.02.00:B2-2

Date: ______________________ Date Published: 3-5-79
Revised: 12-03-79

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UNIT POST TEST: LETTERING

79.01.02.01 -- U.S. Standard

1. The recommended angle for inclined American Standard lettering is:

   a. 90°
   b. 75°
   c. 68°
   d. 60°

2. The lead recommended for lettering in this course is:

   a. H
   b. 2H
   c. 4H
   d. 6H

3. In American Standard Lettering, the height of a lower case letter is what part of the height of an upper case letter?

   a. The same height.
   b. Half the height.
   c. Two-thirds the height.
   d. Three-quarters the height.

4. The general rule for spacing letters within a word is:

   a. The distance between letters should be the size of a zero.
   b. The areas between letters should be about equal.
   c. The distance between letters should be 1/32 of an inch.
   d. The area between letters should be the size of a zero.

5. Guide lines for lettering should be used:

   a. Never
   b. Rarely
   c. Only on 1/8" letters
   d. Always

79.01.02.02 -- Ames Lettering Guide

6. Guide lines drawn with the Ames Guide are drawn with:

   a. 6H
   b. 4H
   c. 2H
   d. H

7. If the reference mark on the Ames Guide is set at 10, what will be the height of the letter?

   a. 1/10"
   b. 5/8"
   c. 5/16"
   d. 1/32"

8. The proper relationship of whole numbers to fraction is shown in:

   a. 1½
   b. $1\frac{1}{2}$
   c. $1\frac{1}{2}$
   d. ^{1}½

9. The requirement(s) for free style lettering is (are):

a. Consistant
b. Neat
c. Legible
d. All of these (a, b, and c)

10. Space between one line and the next is:

a. 1/8"
b. 2/3 letter height
c. Letter height
d. 1/4"

79.01.02.03 -- LeRoy Lettering Guide

11. In your set, you have a LeRoy Template KE-61-0300-120CL. What is the nominal height of the letter?

a. .120 inch
b. 12/32's
c. 120 millimeters
d. .300 inches

12. With the LeRoy, the tracer pin follows the:

a. Edge of the T-square
b. Letters on the template
c. Horizontal guide groove
d. edge of the template

13. The LeRoy Automatic Reservoir Pens consist of:

a. 7 parts
b. 5 parts
c. 3 parts
d. 2 parts

14. The evenly divided spaces on the edge of the lettering guide are used:

a. To measure the height of the letters.
b. To space lines.
c. To space letters on a line.
d. Instead of an architect's scale.

15. Which template do we use for 1/4" letters?

a. 225CL
b. 175CL
c. 140CL
d. 120CL

UNIT POST TEST ANSWER KEY: LETTERING

79.01.02.01

1. C
2. A
3. C
4. B
5. D

79.01.02.02

6. A
7. C
8. C
9. D
10. B

79.01.02.03

11. A
12. B
13. B
14. C
15. B

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Learning Experience Guide

UNIT: GEOMETRIC CONSTRUCTION

RATIONALE:

Much of the work produced by the draftsman is based on plane geometry. However, the true geometric method allows only the use of a straightedge and a compass. In Geometric Construction, you are allowed to use any instrument to do the job with greater speed. The construction problems which will be studied in this Unit are those most often used by draftspersons to solve problems and to construct working drawings.

PREREQUISITES:

Unit: 79.01.02 -- Lettering

OBJECTIVES:

Apply the principles of Geometric Construction by making a drawing of an object from a given illustration.

Identify the terms, principles and techniques used in Geometric Construction.

RESOURCES:

Printed Materials

Basic Technical Drawing. Spencer and Drydon, Macmillan Company, New York.
Engineering Drawing and Graphic Technology. French and Vierck, Eleventh Edition, M McGraw-Hill Book Company, New York.
Mechanical Drawing. French and Svenson, Webster Division, McGraw-Hill Book Company, New York.
Technical Drawing. Sixth Edition, Giesecke, Mitchell, Spencer and Hill, Macmillan Co.

Audio/Visuals

Video cassette for Unit 3.

Equipment

As listed in Course LEG.

GENERAL INSTRUCTIONS:

This unit consists of 22 Learning Activity Packages (LAPs). Each LAP will provide specific information for completion of a learning activity.

Principal Author(s): C. Wetterling
Revised: J. Wheatley

GENERAL INSTRUCTIONS: (continued)

The general procedure for this unit is as follows:

1) Read the first assigned Learning Activity Package (LAP).
2) Begin and complete the first assigned LAP.
3) Take and score the LAP test.
4) Turn in the LAP test answer sheet.
5) Determine the reason for any missed items on the LAP test.
6) Proceed to and complete the next assigned LAP in the unit.
7) Complete all required LAPs for the unit by following steps 3 through 6.
8) In this unit, there are some LAPs that have tests combined with other LAP tests. These combined tests are taken after completing the last LAP covered by the test.
9) Take the unit tests as described in the unit LEG "Evaluation Procedures".
10) Proceed to the next assigned unit.

PERFORMANCE ACTIVITIES:

.01 Dividing a Line into Equal Parts
.02 Bisecting a Line
.03 Enlarging a Drawing
.04 Bisecting an Angle
.05 Copying an Angle
.06 Triangle Construction
.07 Constructing Equilateral Triangles -- Compass and Triangle Method
.08 Square Construction -- Compass and Triangle Method
.09 Inscribing a Square in a Circle -- Triangle and Compass Method
.10 Circumscribing a Square About a Circle -- Triangle and Compass Method
.11 Inscribing a Pentagon in a Circle -- Divider and Geometric Construction Methods
.12 Compass Method of Inscribing a Hexagon in a Circle
.13 Hexagon Construction
.14 Constructing an Octagon
.15 Rectifying an Arc
.16 Drawing an Arc Through Three Points
.17 Drawing a Line Tangent to a Circle
.18 Drawing an Arc Tangent to an Arc and Line
.19 Drawing an Arc Tangent to Two Intersecting Lines
.20 Drawing an Arc Tangent to Two Arcs
.21 Ellipse Construction Trammel, Concentric Circle, and Compass Method
.22 Applying Techniques of Geometric Construction

EVALUATION PROCEDURE:

1. The student takes the LAP multiple-choice pretests. Successful completion is 8 out of 10 items for each LAP.
2. The student takes a multiple-choice unit post test and a unit performance test. Successful unit completion if meeting the listed criteria for the performance test.

FOLLOW-THROUGH:

The skills of Geometric Construction attained in this Unit shall be the basis for construction in future drawings and shall be monitored throughout the entire Course.

NOTE: Do all your drawings on the back of the LAP sheets.

Go to the first assigned LAP listed on your Student Progress Record (SPR).

Student: ____________________ File Code: 79.01.03.00. A2-2

Date: ____________________ Date Published: 6/20/74

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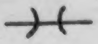
UNIT PRETEST: GEOMETRIC CONSTRUCTION

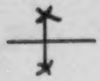
79.01.03.02.

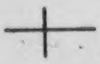
1. Bisect means divide into:

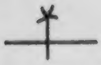
   a. two equal parts.
   b. two parts.
   c. three equal parts.
   d. three parts.

2. Which is the method for bisecting?

   a. 

   b. 

   c. 

   d. 

79.01.03.03.

3. A diagonal is:

   a. a line passing through the center of a sphere.
   b. a line through two points on an arc.
   c. a line from corner-to-corner in figure.
   d. another name for a diameter.

4. A circumscribed regular polygon is:

   a. a secant.
   b. drawn inside of a circle.
   c. drawn around a circle.
   d. cut off on one end not parallel to the base.

79.01.03.03. continued:

5. A line or drawing may be enlarged or reduced by:

   a. inscribing the regular polygon.
   b. drawing diagonals of a geometrical figure to form similar triangles.
   c. bounding the plane figure with straight lines.
   d. bisecting the diagonals.

79.01.03.04.

6. A line segment extending from the center of a circle to the curve is:

   a. a chord.
   b. a diameter.
   c. a radius.
   d. a secant.

7. To divide into two equal parts means to:

   a. inscribe.
   b. bisect.
   c. erect a perpendicular.
   d. trisect.

79.01.03.05.

8. An angle measuring less than 90 degrees is said to be:

   a. acute.
   b. obtuse.
   c. scalene.
   d. isosceles.

9. A triangle with one [illegible] degree angle is:

   a. right triangle.
   b. equilateral triangle.
   c. scalene.
   d. obtuse.

10. A triangle with three sides equal and three angles equal is:

    a. obtuse.
    b. equilateral.
    c. isosceles.
    d. scalene.

79.01.03.06.

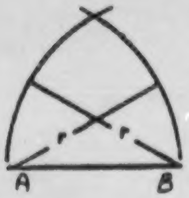
11. Arcs having the same center are said to be:

- a. concentric.
- b. scalene.
- c. secant.
- d. chorded.

79.01.03.08.

12. The construction shown below is a solution to the problem of:

- a. constructing an equilateral triangle.
- b. constructing a right triangle from three given sides.
- c. constructing a perpendicular to line AB.
- d. bisecting line AB.



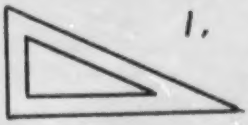
79.01.03.17,18,19,

13. A hexagon has:

- a. five sides.
- b. six sides.
- c. 1/8".
- d. eight sides.

14. The combination of instruments shown below that are used to construct a hexagon is:

- a. 1 and 2.
- b. 2 and 3.
- c. 1 and 3.
- d. 1 and 2 and 3.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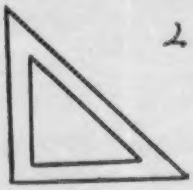
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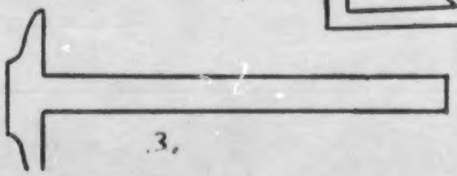
3.

79.01.03.24.

15. To draw a circle through three given points:

    a. use one of the given points as center.
    b. construct perpendicular bisectors of two chords of the arc.
    c. lay off the length of the arc first.
    d. draw a right polygon with the points at the corners.

79.01.03.25,26,27,28.

16. To obtain a smooth joint between tangent lines:

    a. terminate the lines at the point of tangency.
    b. overlap the lines slightly.
    c. draw one of the lines just short of the point of tangency.
    d. draw both lines short of the point of tangency and then fill it in.

17. When drawing tangencies on an ink tracing, draw:

    a. all the curved lines first.
    b. all the straight lines first.
    c. construction lines heavy and dark so they can be seen easily.
    d. the tangent lines in pencil on the tracing, then ink over the pencil.

18. When tracing tangencies in ink, it helps to:

    a. mark the points of tangency with a pencil.
    b. mark the points of tangency with a pen.
    c. not mark the points of tangency.
    d. rub pounce into the pencil copy of the tangencies.

79.01.03.32.

19. The first lines to ink on a drawing are:

    a. circles arcs.
    b. horizontal lines.
    c. vertical lines.
    d. border lines.

20. When corrections are needed on a pencil drawing that is to be inked:

    a. make the corrections in pencil before inking.
    b. make the corrections in ink as you come to them.
    c. make the ink copy, mark the errors, and redraw it.
    d. make the ink copy, then erase and correct errors.

UNIT PRETEST ANSWER KEY: GEOMETRIC CONSTRUCTION

LAP		
02	1.	A
	2.	B
03	3.	C
	4.	C
	5.	B
04	6.	C
	7.	B
05	8.	A
	9.	A
	10.	B
06–24	11.	A
	12.	A
	13.	B
	14.	C
	15.	B
25–32	16.	D
	17.	D
	18.	A
	19.	A
	20.	A

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File Code: 79.01.03.01;A2-0

Date Published: 11-4-75
Revised: 8-15-79

Learning Activity Package

Student: ____________________

Date: ____________________

PERFORMANCE ACTIVITY: Dividing a Line Into Equal Parts

OBJECTIVE:

Divide a given line into equal parts using a geometric construction method.

EVALUATION PROCEDURE:

The instructor will check the procedure of the construction and check the accuracy with a divider. No errors are allowed on this LAP.

Successful completion of this LAP is determined by correctly answering 8 out of 10 items on a multiple-choice test that is combined with "Enlarging a Drawing" LAP test and is taken after completing LAP .03.

RESOURCES:

Basic Technical Drawing, pg. 71 (Fig. 5-2 and 5-3)
Basic Drafting Tools: (see Unit LEG)
Drafting Furniture: (see Unit LEG)

PROCEDURE:

1. Read the resource(s).

2. On the back of this paper divide three lines into the following parts:

   (Do not use your scale except to draw the given line to length)

   Line AB 3 5/8 long into 3 equal parts.
   Line CD 6 7/32 long into 7 equal parts.
   Line EF 4 1/2 long into 5 equal parts.

3. Write the definition for the following words on this sheet (use good freehand lettering) and illustrate the definition with a sketch:

   parallel
   perpendicular
   vertical
   horizontal
   inclined

4. Have the work evaluated.

Principal Author(s): C. Wetterling, S. Vosen
Revised: J. Wheatley

File Code: 79.01.03.02.A2-0

Date Published: 11/4/75
Revised Date: 8-15-79

Mountain-Plains Education &
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Glasgow AFB, Montana 59231

Learning Activity Package

Student:

Date:

PERFORMANCE ACTIVITY: BISECTING A LINE

OBJECTIVE:

Bisect a given line using first, the triangle method, and second the geometric construction or compass method.

EVALUATION PROCEDURE:

The instructor will check the procedure of construction and accuracy of the work with a divider or scale. No errors are allowed on this LAP.

Successful completion of this LAP is determined by correctly answering 8 out of 10 items on a multiple-choice test that is combined with "Enlarging a Drawing" LAP test and is taken after completing LAP 03.

RESOURCES:

Basic Technical Drawing, pg. 71 (Fig. 5-5)
Technical Drawing, pg. 91 (Fig. 4.8 and Fig. 4.9)

Basic Drafting Tools: (See Unit LEG)
Drafting Furniture: (See Unit LEG)

PROCEDURE:

1. Read the above resource(s) for the two procedures for bisecting a line.

2. Bisect each line below twice, once using the triangle method, and once using the geometric construction method. (Compass method).

   Line 1: 2 7/8 inches
   Line 2: 1 3/4 inches
   Line 3: 3 inches

3. Write definitions for the following terms on the same drawing sheet using good freehand lettering:

   Bisect
   Intersect

4. Have the work evaluated.

Principal Author(s): C. Dvorak
Revised by: S. Vosen, J. Wheatley

File Code: 79.01.03.03.A1-0

Date Published: 11/4/75

Date Revised: 3/5/80

Mountain-Plains Education &
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Learning Activity Package

Student: ______________________

Date: ______________________

PERFORMANCE ACTIVITY: ENLARGING A DRAWING

OBJECTIVE:

Enlarge a drawing using the proportional dividers.

EVALUATION PROCEDURE:

The instructor will evaluate the procedure and check the accuracy of the work using a scale and dividers. No errors are allowed.

Successful completion of this LAP is determined by correctly answering 8 out of 10 items on a multiple-choice test.

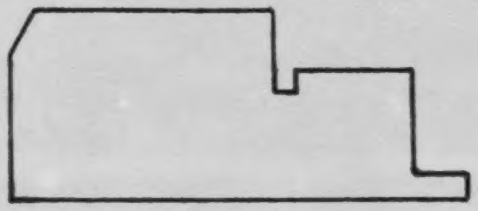
RESOURCES:

Technical Drawing, pg. 40 (para. 2-41 & Fig. 2.50)
Instructions for Using Proportional Dividers.
Basic Drafting Tools: (See Unit LEG)
Drafting Furniture: (See Unite LEG)
Proportional Dividers

PROCEDURE:

1. Read the above resource(s).
2. Practice with the proportional dividers and apply it to the drawing shown below.
3. Enlarge the drawing to twice its original size on a separate sheet of paper.

   NOTE: Do not use a scale to make the enlargement.
4. List 2 other means of enlarging a drawing.



5. Have your work evaluated and take the LAP test.

Principal Author(s): C. Dvorak
Revised by: S. Vosen, J. Wheatley

Student: ______________________ File Code: 79.01.03.01/03.A2-0

Date: ______________________ Date Published: 3/5/80

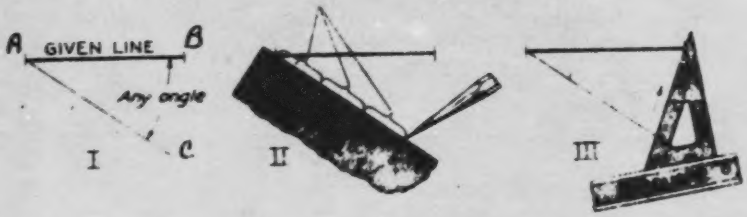
Family Education Program

LAP TEST: Dividing a Line Into Equal Parts/Bisecting a Line/Enlarging a Drawing

79.01.03.01

1. The construction shown below is a solution to the problem of:

   a. drawing lines parallel to AB.
   b. dividing line A into a number of equal parts.
   c. constructing a development.
   d. dividing line AB into a number of equal parts.



2. To intersect means to:

   a. cut across.
   b. divide into two equal parts.
   c. use a compass on it.
   d. use dividers.

3. A line which is perpendicular to a horizontal line is:

   a. bisected.
   b. vertical
   c. inclined.
   d. parallel.

4. Using the method shown on LAP .01, you can divide a line into:

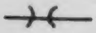
   a. 7 parts.
   b. 4 parts.
   c. 2 parts .
   d. all the above.

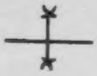
79.01.03.02

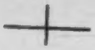
5. Bisect means to divide into:

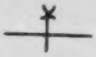
   a. two equal parts.
   b. two parts.
   c. three equal parts.
   d. three parts.

6. Which is the geometric method for bisecting a line?

   a. 

   b. 

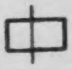
   c. 

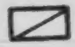
   d. 

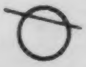
7. The triangle method of bisecting a line uses which angle of the triangles?

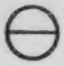
   a. 30°
   b. 45°
   c. 60°
   d. all of the above.

8. An example of a diagonal is:

   a. 

   b. 

   c. 

   d. 

79.01.03.03

9. The proportional dividers should be set on what number to double or halve a dimension?

   a. 1
   b. 2
   c. 3
   d. ½

10. Which of the following is NOT a method used to enlarge a drawing?

   a. Inclined Method
   b. Diagonal Method
   c. Grid Square Method
   d. Proportional Method

79.01.03.01/03.A2-0
3/5/80

LAP TEST ANSWER KEY:

Dividing A Line Into Equal Parts/
Bisecting a Line/
Enlarging A Drawing

LAP		
01	1.	D
	2.	A
	3.	B
	4.	D
02	5.	A
	6.	B
	7.	D
	8.	B
03	9.	B
	10.	A

Mountain-Plains Education &
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File Code: 79.01.03.04.A1-0

Date Published: 11/4/75
Date Revised: 3/5/80

Learning Activity Package

Student: ____________________

Date: ____________________

PERFORMANCE ACTIVITY: BISECTING AN ANGLE

OBJECTIVE:

Bisect a given angle using the compass method.

EVALUATION PROCEDURE:

Successful completion of this LAP is determined by correctly answering 8 out of 10 items on a multiple-choice test that is combined with "Copying An Angle" LAP test and is taken after completing that LAP.

RESOURCES:

Basic Technical Drawing, pg. 72 (Fig. 507).

Basic Drafting Tools: (See Unit LEG)
Drafting Furniture: (See Unit LEG)

PROCEDURE:

1. Read the above resource(s) for the procedure to bisect an angle.

2. Practice this method by bisecting all the angles of the following triangles: (See page 2.) Do not use your protractor to bisect the angles.

3. What must the sum of the interior angles of a triangle total? _____ degrees

4. Measure each angle with a protractor. Write your answers below:

   A = _____ degrees
   B = _____ degrees
   C = _____ degrees
   E = _____ degrees
   F = _____ degrees
   G = _____ degrees
   M = _____ degrees
   N = _____ degrees
   O = _____ degrees

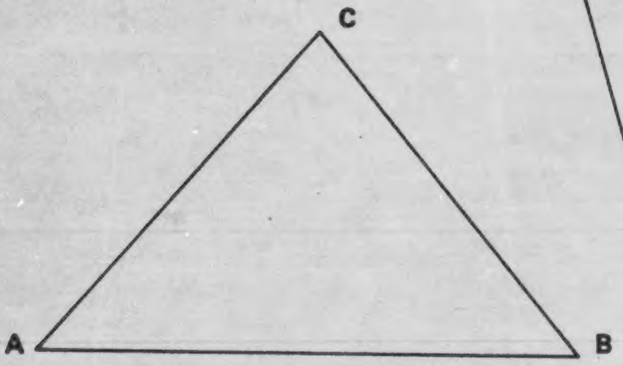
5. Write the definition for the following terms (use good freehand lettering):

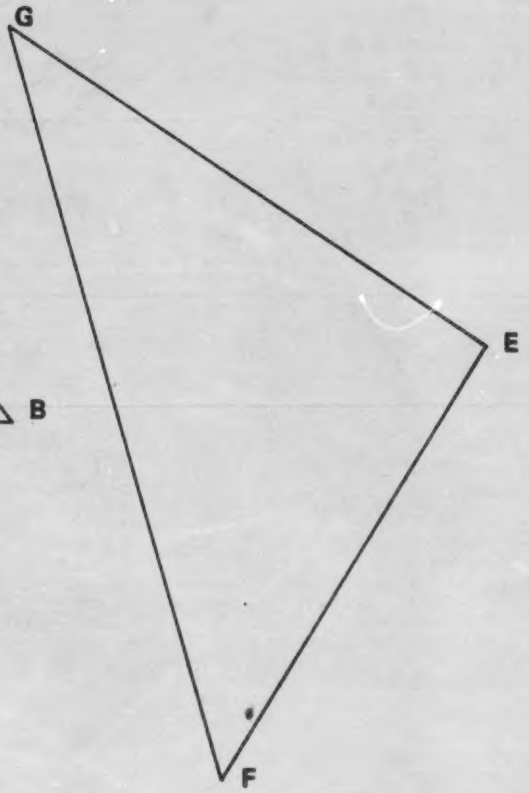
   A. Radius
   B. Arc
   C. Angle

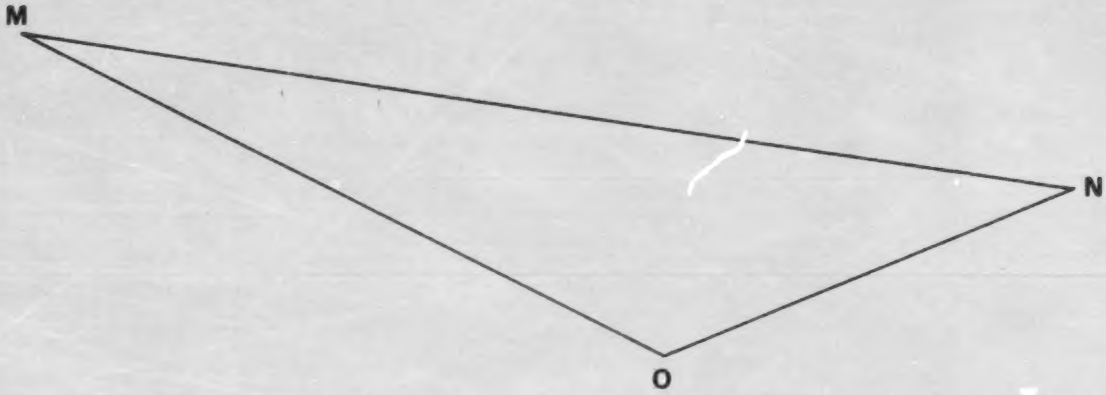
6. Have your work evaluated, and go on to LAP .05. The LAP test will be taken after LAP .05.

Principal Author(s): C Wetterling
Revised by: S. Vosen
J. Wheatley

2. Continued:







(NOTE: How can you tell if your bisectors are accurate?)

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Date Published: 11/4/75
Date Revised: 8-15-79

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Learning Activity Package

Student: ____________________

Date: ____________________

PERFORMANCE ACTIVITY: COPYING AN ANGLE

OBJECTIVE:

Copy a given angle at a new location using the compass method.

EVALUATION PROCEDURE:

Instructor will check work for the proper procedure and accuracy of transferring an angle to a new location. An allowance of 1/2° will be considered satisfactory.

Successful completion of this LAP is determined by correctly answering 8 out of 10 items on a multiple-choice test.

RESOURCES:

Basic Technical Drawing, pg. 72 (5-8)

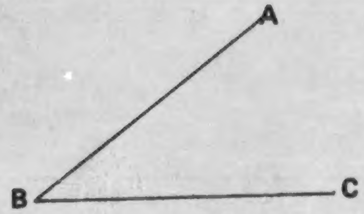
Basic Drafting Tools: (See Unit LEG)
Drafting Furniture: (See Unit LEG)

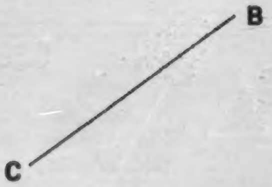
PROCEDURE:

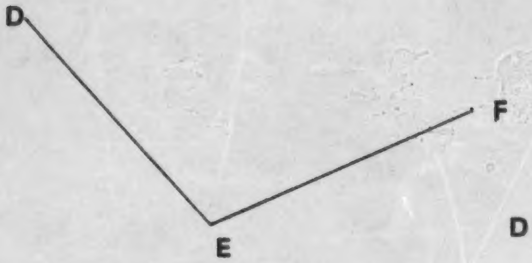
1. Read the above resource(s).
2. Copy the following angles at their new locations using the method given in the Resource(s).

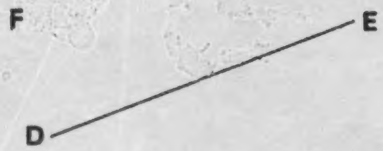
   (See Page 2)

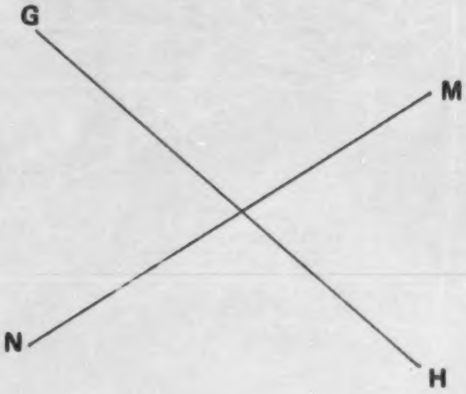
Principal Author(s): C. Dvorak

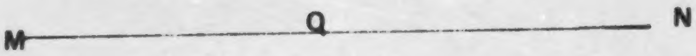

A
B
C


B
C


D
F
E


E
D


G
M
N
H


M
Q
N

3. Give the definition for the following terms (use good freehand lettering).

   A. Chord

   B. Acute angle

   C. Isosceles triangle

   D. Right triangle

   E. Scalene triangle

   F. Vertex

   G. Base (of a triangle)

   H. Equilateral triangle

4. Have the instructor evaluate your work.

5. Take the LAP test.

Student: ____________________ File Code: 79.01.03.04/05.A2-0

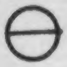
Date: ____________________ Date Published: 6/20/74
Revised: 3/5/80

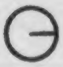
Family Education Program

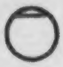
LAP TEST: Bisecting An Angle/Copying An Angle

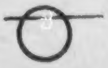
79.01.03.04

1. An example of a radius is:

a.


b.


c.


d.


2. A line segment extending from the center of a circle to the curve is:

   a. a chord.
   b. a diameter.
   c. a radius.
   d. a secant.

3. A continuous portion of a circle or curve is:

   a. a chord.
   b. a secant.
   c. an arc.
   d. a radius.

4. The figure formed by two lines extending from the same point is:

   a. an angle.
   b. a secant.
   c. a polygon.
   d. a diagonal.

5. If all 3 angles of a triangle are bisected, the bisectors:

   a. are parallel.
   b. are perpendicular.
   c. meet at one point.
   d. form a triangle.

79.01.03.05

6. A straight line joining two points on a curve is:

   a. a radius.
   b. a chord.
   c. a diagonal.
   d. an arc.

79.01.03.05 (continued)

7. A triangle with two sides equal and two angles equal is:

   a. right triangle.
   b. scalene.
   c. obtuse.
   d. isosceles.

8. A triangle with one 90 degree angle is:

   a. right triangle.
   b. equilateral triangle.
   c. scalene.
   d. obtuse.

9. A triangle with no sides or angles equal is:

   a. isosceles.
   b. obtuse.
   c. equilateral.
   d. scalene.

10. The point of intersection of lines is called:

   a. vertex.
   b. chord.
   c. secant.
   d. acute.

79.01.03.04/05.A2-0
3/5/80

LAP TEST ANSWER KEY

Bisecting An Angle/ Copying An Angle

LAP		
04	1.	B
	2.	C
	3.	C
	4.	A
	5.	C
05	6.	B
	7.	D
	8.	A
	9.	D
	10.	A

File Code: 79.01.03.06.A1-0

Date Published: 11/4/75
Date Revised: 3/5/80

Mountain-Plains Education &
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Glasgow AFB, Montana 59231

Learning Activity Package

Student: ____________________

Date: ____________________

PERFORMANCE ACTIVITY: TRIANGLE CONSTRUCTION

OBJECTIVE:

Construct a triangle with three given sides using the compass method.

EVALUATION PROCEDURE:

The instructor will check your work for accuracy and proper procedure. No errors are allowed on this LAP.

Successful completion of this LAP is determined by correctly answering 8 out of 10 items on a multiple-choice test that is combined with "Constructing Equilateral Triangles" LAP test and is taken after completing that LAP.

RESOURCES:

Basic Technical Drawing, pg. 72 (Fig. 5-9)

Basic Drafting Tools: (See Unit LEG)
Drafting Furniture: (See Unit LEG)

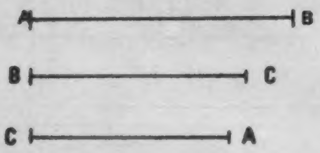
PROCEDURE:

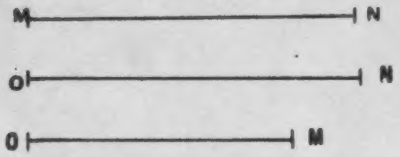
1. Read the above resource(s).

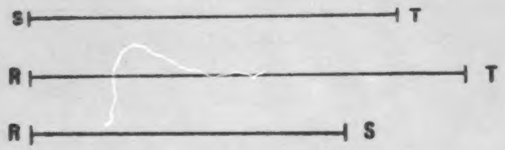
2. Construct three triangles with the following given sides (use the procedure outlined in the reference material):

   (See Page 2)

Principal Author(s): C. Dvorak
Revisions: J. Wheatley







3. Give the definitions for the following terms (use good freehand lettering).

   a) Hypotenuse

   b) Concentric arcs

   c) Concentric circles

4. Have the instructor evaluate this LAP.

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File Code: 79.01.03.07:A1-0

Date Published: 11-4-75

Revised: 3-5-80

Learning Activity Package

Student: ______________________

Date: ______________________

PERFORMANCE ACTIVITY: Constructing Equilateral Triangles -- Compass and Triangle Methods

OBJECTIVES:

Given the side, construct an equilateral triangle using the compass method of constructions. Given the side, draw an equilateral triangle using the triangle method.

EVALUATION PROCEDURE:

The instructor will evaluate work for proper construction methods. No errors are allowed on this LAP.

Successful completion of this LAP is determined by correctly answering 8 out of 10 items on a multiple-choice test. The LAP test is taken after completing this LAP.

RESOURCES:

Basic Technical Drawing, page 72 (Fig. 5-11) and page 73 (Fig. 5-13a)
Basic Drafting Tools: (see Unit LEG)
Drafting Furniture: (see Unit LEG)

PROCEDURE:

1. Read the above Resource(s).
2. Construct three triangles with the given sides using both methods--(use back of this sheet).

   2 7/8" 3 1/16" 1 19/32"

3. Have the instructor evaluate your LAP.
4. Take the LAP test.

Principal Author(s): C. Dvorak, J. Wheatley

Student: ______________________ File Code: 79.01.03.06/07.A2-0

Date: ______________________ Date Published: 3/5/80

Family Education Program

LAP TEST: Triangle Construction/Constructing Equilateral Triangles

79.01.03.06

1. The side of a right triangle that is opposite the right angle is:

   a. the secant.
   b. the chord.
   c. the hypotenuse.
   d. the isosceles.

2. Arcs having the same center are said to be:

   a. concentric.
   b. scalene.
   c. secant.
   d. chorded.

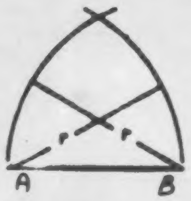
79.01.03.07

3. An equilateral triangle has:

   a. a 90 degree angle.
   b. three sides unequal.
   c. three sides equal.
   d. at least one 75 degree angle.

4. The construction shown below is a solution to the problem of:

   a. constructing an equilateral triangle.
   b. constructing a right triangle from three given sides.
   c. constructing a perpendicular to line AB.
   d. bisecting line AB.



5. If you drew a triangle using the lengths given below, the largest angle would be opposite which side?

   a. Side A = 2 1/8
   b. Side B = 1 7/8
   c. Side C = 1 3/8
   d. All the angles will be the same.

79.01.03.06/07.A2-0
3/5/80

LAP TEST ANSWER KEY:

Triangle Construction/
Constructing Equilateral Triangles

LAP		
06	1.	C
	2.	A
07	3.	C
	4.	A
	5.	A

File Code: 79.01.03.08:A1-0

Date Published: 11-5-75

Revised: 3-5-80

Mountain-Plains Education &
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Glasgow AFB, Montana 59231

Learning Activity Package

Student: ____________________

Date: ____________________

PERFORMANCE ACTIVITY: Square Construction -- Compass and Triangle Methods

OBJECTIVE:

Draw a square using the triangle method.
Construct a square using the compass method.

EVALUATION PROCEDURE:

The instructor will visually inspect the construction checking for accuracy and proper procedures. You will be allowed no errors on this LAP. The LAP test is combined with LAPs 09 and 10.

RESOURCES:

Basic Technical Drawing, page 73 (Fig. 5.13b)
Technical Drawing, page 96 (para 4.23 and Fig. 4.23a)
Basic Drafting Tools: (see Unit LEG)
Drafting Furniture: (see Unit LEG)

PROCEDURE:

1. Read the above resource(s).
2. Draw a square with a side of 2 3/8" using the triangle method on the back of this sheet.

   NOTE: DO NOT circumscribe a square about a circle.

3. Construct two squares using the compass method on the back of this sheet of paper.

   One square shall have a diagonal measurement of 2 3/4".
   The other square shall have a side of 1 3/8".

   NOTE: DO NOT use the method of inscribing or circumscribing with a circle.
   You are not allowed to use a T-square.

4. How many degrees does the sum of the interior angles of the square equal?

   ____________ degrees

5. Have the instructor check your work.
6. Go on to the next LAP. The LAP test is combined with LAP s 09 and 10.

Principal Author(s): C. Wetterling, S. Vosen, J. Wheatley

File Code: 79.01.03.09: A1-0

Date Published: 11-5-75
REVISED: 3-5-80

Mountain-Plains Education &
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Glasgow AFB, Montana 59231

Learning Activity Package

Student: ____________________

Date: ____________________

PERFORMANCE ACTIVITY: Inscribing a Square in a Circle -- Triangle and Compass Method

OBJECTIVES:

Inscribe a square in a circle using the compass method.
Inscribe a square in a circle using the triangle method.

EVALUATION PROCEDURE:

The instructor will visually inspect your work for accuracy and correct construction procedure. You will be allowed no errors on this LAP. Successful completion of this LAP is determined by the instructors evaluation and successful completion of the LAP test.

RESOURCES:

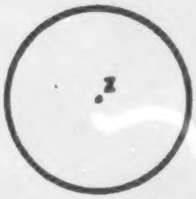
Basic Technical Drawing, page 73 (Fig. 5.13d)
Basic Drafting Tools: (see Unit LEG)
Drafting Furniture: (see Unit LEG)

PROCEDURE:

1. Read the above Resource(s).
2. Use the triangle method to inscribe a square in a circle with a 4 1/8" diameter.
3. Study the following steps for inscribing a square in a circle using the compass method.

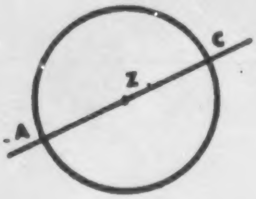
Steps

A. Draw a circle with center Z with desired radius or diameter using a compass.

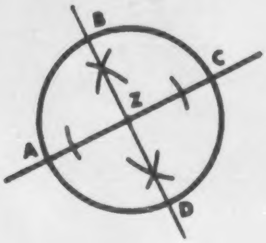


Principal Author(s): C. Dvorak, C. Wetterling, S. Vosen, J. Wheatley

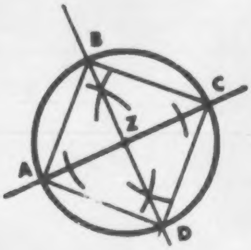
B. Use a triangle as a straight edge for drawing line AC through the center (Z) of the circle at an angle from the horizontal. (NOTE: Do not use the "T"-square)



C. Use a compass to construct line BD perpendicular to line AC at point Z.



D. The four points (A, B, C & D) on the circle are the corners of the desired square ABCD. Use a triangle as a straight edge to draw lines AB, BC, CD and DA, thus completing the inscribed square ABCD.



4. On a separate sheet inscribe a square in a circle having a two-inch diameter. Use the compass method.

NOTE: Do not use a T-square.

5. Have the construction evaluated by the instructor.

6. The LAP test is combined with LAP 10. Proceed to next LAP.

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Date Published: 11-5-75
Revised: 3-5-80

Learning Activity Package

Student: ______________________

Date: ______________________

PERFORMANCE ACTIVITY: Circumscribing a Square About a Circle -- Triangle and Compass Methods

OBJECTIVES:

Circumscribe a square about a circle using the compass method. Circumscribe a square about a circle using the triangle method.

EVALUATION PROCEDURE:

The instructor will examine drawing for accuracy and proper construction techniques. No errors are allowed on work. Successful completion of this LAP is determined by the instructors evaluation and scoring 80% on the LAP test.

RESOURCES:

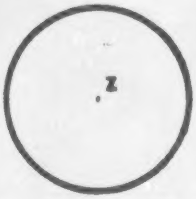
Basic Technical Drawing, page 73 (Fig. 5.13c)
Basic Drafting Tools: (see Unit LEG)
Drafting Furniture: (see Unit LEG)

PROCEDURE:

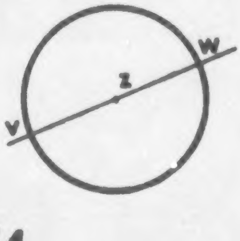
1. Read the above resource(s).
2. Construct a square around a circle with a three-inch diameter using the triangle method.
3. Read the following steps.

Steps

A. Draw a circle with required diameter or radius.

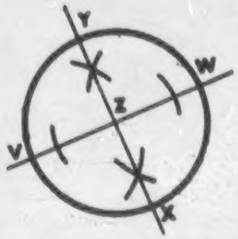


B. Using a triangle, draw a line VW through the center Z of the circle. (NOTE: Do not use your "T" square).

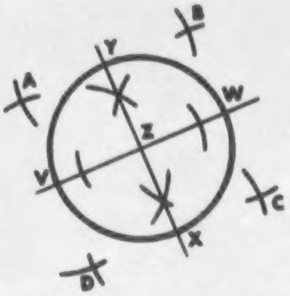


Principal Author(s): Q. Fogleman
S. Vosen, J. Wheatley

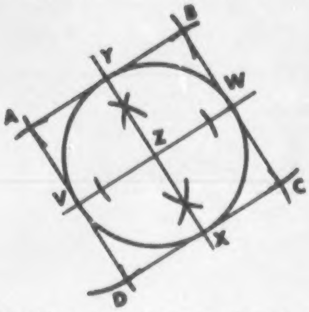
C. Construct perpendicular line XY at point Z using a compass.



D. Locate points A, B, C and D using a compass set at the radius of the circle.



E. Draw lines AB, BC, CD and DA. Square ABCD in the circumscribed square.



2. In a drawing, circumscribe a square about a 4 inch circle using the compass method.

   NOTE: You are not allowed to use a T-square.

3. Have the construction evaluated by the instructor.

4. Take the combined LAP test. Proceed to the next LAP.

Student: ______________________ File Code: 79.01.03.08/09/10.A2-0

Date: ______________________ Date Published: 3/5/80

Family Education Program

LAP TEST: Square Construction/Inscribing a Square in a Circle/Circumscribing a Square About a Circle

79.01.03.08

1. A line drawn from one corner of a square to the opposite corner is a:

   a. diagonal.
   b. perpendicular.
   c. parallel.
   d. hypotenuse.

2. A square is a:

   a. regular polyhedron.
   b. regular polygon.
   c. irregular polyhedron.
   d. irregular polygon.

3. What is the sum of the interior angles of a square?

   a. 45^{o}
   b. 90^{o}
   c. 180^{o}
   d. 360^{o}

79.01.03.09

4. The two diagonals of a square:

   a. are the same length as the side of a square.
   b. are perpendicular and bisect each other.
   c. bisect the sides of a square.
   d. are the diameter of a circle inscribed in the square.

79.01.03.10

5. The diameter of a circle circumscribed around a square:

   a. is the length of the diagonals of the square.
   b. is twice the length of a side of the square.
   c. is the length of a side of the square.
   d. cannot be found.

79.01.03.08/09/10.A2-0
3/5/80

LAP TEST ANSWER KEY:

Square Construction/Inscribing a Square in a Circle/Circumscribing a Square About a Circle

LAP		
08	1.	A
	2.	B
	3.	D
09	4.	B
10	5.	A

Mountain-Plains Education &
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File Code: 79.01.03.11:A2-0

Date Published: 11-6-75
Revised: 8-15-79

Learning Activity Package

Student: ______________________

Date: ______________________

PERFORMANCE ACTIVITY: Inscribing a Pentagon In a Circle -- Divider and Geometric Construction Methods.

OBJECTIVES:

Inscribe a pentagon in a given circle using the divider method.
Inscribe a pentagon in a given circle using the geometric construction method.

EVALUATION PROCEDURE:

Successful completion of this LAP is determined by correctly answering 8 out of 10 items on a multiple-choice test that is combined with "Drawing an Arc Through Three Points" LAP test and is taken after completing that LAP.

RESOURCES:

Technical Drawing, Page 97 (Fig. 4.24)
Basic Technical Drawing, Page 73 (Fig. 5-13e)
Engineering Drawing and Graphic Technology, Page 74
Basic Drafting Tools: (see Unit LEG)
Drafting Furniture: (see Unit LEG)

PROCEDURE:

1. Read the following procedure for inscribing a pentagon in a circle:
   a. Construct a circle of the given diameter.
   b. Open the divider to distance less than 1/4 of the circumference and as close to 1/5 as you can estimate.
   c. From a starting point, A on the circle, mark five consecutive distances using the divider as set in Step (b).
   d. If your fifth mark falls on the starting point, you have successfully found the five corners of the pentagon. Go to Step (e).
   If your fifth mark was short of the starting point, lengthen the distance on your divider and take Steps (c) and (d).
   If your fifth mark was past the starting point, shorten the distance on your dividers and take Steps (c) and (d).
   e. Connect the five corners of the pentagon that you have located.

Principal Author(s): Q. Fogleman, S. Vosen, J. Wheatley

PROCEDURES: (continued)

2. Inscribe a pentagon in a circle with a 3 1/2 inch diameter using the preceding method.

3. Read the assigned Resource(s).

4. Inscribe a pentagon in a circle of 3 1/2 inch diameter using the geometric construction method.

5. How many degrees is each interior angle? ________________

6. Have the instructor evaluate your work.

7. Proceed to the next LAP.

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Mountain-Plains Education &
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Glasgow AFB, Montana 59231

Learning Activity Package

Student: ____________________

Date: ____________________

PERFORMANCE ACTIVITY: COMPASS METHOD OF INSCRIBING A HEXAGON IN A CIRCLE

OBJECTIVE:

Inscribe a hexagon in a given circle using the compass method.

EVALUATION PROCEDURE:

The instructor will evaluate your work checking for accuracy and proper construction techniques. You will not be allowed any errors on this LAP.

Successful completion of this LAP is determined by correctly answering 8 out of 10 items on a multiple-choice test that is combined with "Drawing an Arc Through Three Points" LAP test and is taken after completing that LAP.

RESOURCES:

Basic Technical Drawing, pg. 73 (Fig. 5.13f)
Technical Drawing, pg. 97 (Fig. 4.25b)
Engineering Drawing and Graphic Technology, pg. 73

Basic Drafting Tools: (See Unit LEG)
Drafting Furniture: (See Unit LEG)

PROCEDURE:

1. Read the above resource(s).
2. Draw a circle with a 3 1/2 inch diameter on the back of this sheet.
3. Inscribe a hexagon in the circle using the compass method described in the reference(s).
4. How many degrees is each interior angle? __________°
5. Have the instructor evaluate the construction.

Principal Author(s): J. Schye
Revised by: S. Vosen, J. Wheatley

Mountain-Plains Education &
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File Code: 79.01.03.13;A2-0

Date Published: 11-6-75

Revised: 8-15-79

Learning Activity Package

Student: ____________________

Date: ____________________

PERFORMANCE ACTIVITY: Hexagon Construction -- Given Distance Across Points or Flats or Length of a Side.

OBJECTIVE:

Construct a hexagon given the distance across flats.
Construct a hexagon given the length of its side.
Construct a hexagon given the distance across points.

EVALUATION PROCEDURE:

Successful completion of this LAP is determined by correctly answering 8 out of 10 items on a multiple-choice test that is combined with "Drawing an Arc Through Three Points" LAP test and is taken after completing that LAP.

RESOURCES:

Basic Technical Drawing, pg. 73 (Figures 5-13g, h, and i)
Technical Drawing, pg. 97 and 98 (para. 4.26, Fig. 4.26)
Basic Drafting Tools: (see Unit LEG)
Drafting Furniture: (see Unit LEG)

PROCEDURE:

1. Read the above Resource(s).
2. On the back of this sheet construct (3) hexagons with the following information given:

   a) A hexagon with the side length 1½".
   b) A hexagon that is 2¼" across points.
   c) A hexagon that is 1 3/4" across flats.

3. Have your hexagons evaluated.

Principal Author(s): J. Schye, J. Wheatley

Mountain-Plains Education &
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Glasgow AFB, Montana 59231

File Code: 79.01.03.14:A2-0

Date Published: 11-6-75
Revised: 8-16-79

Learning Activity Package

Student: ____________________

Date: ____________________

PERFORMANCE ACTIVITY: Constructing an Octagon

OBJECTIVE:

Circumscribe an octagon around a given circle.
Inscribe an octagon in a given circle.
Inscribe an octagon in a square.

EVALUATION PROCEDURE:

The instructor will evaluate your work checking for accuracy and proper construction techniques. You will be allowed no errors on this LAP.

Successful completion of this LAP is determined by correctly answering 8 out of 10 items on a multiple-choice test that is combined with "Drawing an Arc Through Three Points" LAP test and is taken after completing that LAP.

RESOURCES:

Basic Technical Drawing, page 73 (Figures 5-13K, M and N)
Technical Drawing, page 98 (Figure 4.28)

Basic Drafting Tools: (see Unit LEG)
Drafting Furniture: (see Unit LEG)

PROCEDURE:

1. Read the above resource(s).
2. Construct a 1½" diameter circle, a 2" diameter circle, and a 2" square on the back of this sheet.
3. Circumscribe an octagon around the 1½" circle, inscribe an octagon in the 2" circle, and inscribe an octagon in the square.
4. How many degrees is each interior angle of an octagon? _______ degrees
5. Have the construction evaluated.

Principal Author(s): C. Wetterling, S. Vosen, J. Wheatley

File Code: 79.01.03.15:A2-0

Date Published: 11-6-75
Revised: 8-16-79

Mountain-Plains Education &
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Glasgow AFB, Montana 59231

Learning Activity Package

Student: ______________________

Date: ______________________

PERFORMANCE ACTIVITY: Rectifying an Arc

OBJECTIVE:

Lay off a given straight line on a given arc.
Lay off a given arc on a straight line.

EVALUATION PROCEDURE:

The instructor will evaluate your work checking for accuracy and proper construction techniques. You will be allowed no errors on this LAP.

Successful completion of this LAP is determined by correctly answering 8 out of 10 items on a multiple-choice test that is combined with "Drawing an Arc Through Three Points" LAP test and is taken after completing that LAP.

RESOURCES:

Basic Technical Drawing, page 73 (Figure 5-15)
Technical Drawing, page 106 (para. 4.46)
Basic Drafting Tools: (see Unit LEG)
Drafting Furniture: (see Unit LEG)

PROCEDURE:

1. Read the above resource(s).
2. Draw a line 2" long and an arc tangent to it with a 3" radius.
3. Lay off a 2" circumference on the arc using the method in Basic Technical Drawing.
4. Given a circle with a 2" diameter, lay off 1/6 of its circumference on a straight line.
5. Have the constructions evaluated.

Principal Author(s): C. Wetterling, S. Vosen, J. Wheatley

File Code: 79.01.03.16;A2-0

Date Published: 11/6/75
Revised Date: 8-16-79

Mountain-Plains Education &
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Learning Activity Package

Student: ____________________

Date: ____________________

PERFORMANCE ACTIVITY: Constructing an Arc Through Three Points

OBJECTIVE:
Construct an arc through three given points.

EVALUATION PROCEDURE:

The instructor will evaluate your work checking for accuracy and proper construction techniques. You will be allowed no errors on this LAP.

Successful completion of this LAP is determined by correctly answering 8 out of 10 items on a multiple-choice test.

RESOURCES:

Basic Technical Drawing, pg. 73 (Fig. 5-14)

Basic Drafting Tools: (See Unit LEG)
Drafting Furniture: (See Unit LEG)

PROCEDURE:

1. Read the above resource(s).
2. Make three points (A, B & C) on the back of this sheet.

   The distance from A to B is 2 inches.

   The distance from B to C is 3 inches.

   The distance from A to C is 3 1/2 inches.

   HINT: Construct a triangle with these 3 sides.
3. Draw a circle through the three points.
4. Have the construction evaluated.
5. Take the LAP test.

Principal Author(s): J. Schye
Revised by: S. Vosen, J. Wheatley

File Code: 79.01.03.17:A2-0

Date Published: 11/6/75
Date Revised: 8-16-79

Mountain-Plains Education &
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Glasgow AFB, Montana 59231

Learning Activity Package

Student: ______________________

Date: ______________________

PERFORMANCE ACTIVITY: Constructing a Line Tangent to a Circle and a Circle Tangent to a Line

OBJECTIVE:

Construct a line tangent to a given circle at a given point on the circle. Draw a circle tangent to a given line at a given point.

EVALUATION PROCEDURE:

Instructor will evaluate for accuracy and construction method with no errors permitted.

Successful completion of this LAP is determined by correctly answering 8 out of 10 items on a multiple-choice test that is combined with "Applying Techniques of Geometric Construction" LAP test and is taken after completing that LAP.

RESOURCES:

Basic Technical Drawing, pg. 73 (Fig. 5-16) pg. 74 (Fig. 5-17)
Technical Drawing, pg. 101 (Fig. 4.33) & (Fig. 4.34)

Basic Drafting Tools: (See Unit LEG)
Drafting Furniture: (See Unit LEG)

PROCEDURE:

1. Read the above resource(s).
2. On the other side of this sheet, draw a circle with a 2 inch diameter.
3. Mark a point on the circle and label it (A).
4. Construct a line tangent to the circle at point (A).
5. Draw a 3 inch long inclined line and construct a 1 1/2 inch diameter circle tangent to the center point of the line.
6. Have your work evaluated.

Principal Author(s): C. Wetterling
Revised by: S. Vosen, J. Wheatley

File Code: 79.01.03.18;A2-0

Date Published: 11/6/75
Date Revised: 8-16-79

Mountain-Plains Education &
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Glasgow AFB, Montana 59231

Learning Activity Package

Student: ____________

Date: ____________

PERFORMANCE ACTIVITY: Constructing an Arc Tangent to an Arc and Line

OBJECTIVE:

Construct an arc tangent to a given arc and a given line. (2 cases).

EVALUATION PROCEDURE:

Instructor will evaluate for accuracy and construction method with no errors allowed.

Successful completion of this LAP is determined by correctly answering 8 out of 10 items on a multiple-choice test that is combined with "Applying Techniques of Geometric Construction" LAP test and is taken after completing that LAP.

RESOURCES:

Basic Technical Drawing, pg. 75 (Fig. 5-19, a & b)
Engineering Drawing and Graphic Technology, pg. 66, para. 15
Technical Drawing, pg. 104 (Fig. 4.39)
Basic Drafting Tools: (See Unit LEG)
Drafting Furniture: (See Unit LEG)

PROCEDURE:

1. Read the above resource(s).
2. Case I - On the back of this sheet, draw an arc with a radius of 3/4 inch.
3. Draw a line segment 1 inch from the arc.
4. Construct an arc with a 7/8 inch radius tangent to the given arc and line.
5. Find all points of tangency.
6. Case II - On the back of this sheet, draw an arc with a 4 inch radius.
7. Draw a line passing thru the center of the arc and intersecting the arc.
8. Construct a 1/2 inch radius arc tangent to the given arc and line. Mark the points of tangency.
9. Have the instructor evaluate the construction.

Principal Author(s): C. Wetterling
Revised by: S. Vosen, J. Wheatley

File Code: 79.01.03.19:A2-0

Date Published: 11/6/75

Date Revised: 8-16-79

Mountain-Plains Education &
Economic Development
Program, Inc.
Glasgow AFB, Montana 59231

Learning Activity Package

Student: ____________________

Date: ____________________

PERFORMANCE ACTIVITY: Constructing an Arc Tangent to Two Intersecting Lines

OBJECTIVE:

Construct an arc tangent to two intersecting lines.

EVALUATION PROCEDURE:

Instructor will evaluate for accuracy and construction method with no errors allowed.

Successful completion of this LAP is determined by correctly answering 8 out of 10 items on a multiple-choice test that is combined with "Applying Techniques of Geometric Construction" LAP test and is taken after completing that LAP.

RESOURCES:

Basic Technical Drawing, pg. 74 (Fig. 5-18).

Basic Drafting Tools: (See Unit LEG)
Drafting Furniture: (See Unit LEG)

PROCEDURE:

1. Read the above resource(s).
2. On the back upperhalf of this sheet, draw two perpendicular intersecting lines.
3. On the lower half of the sheet, draw two intersecting lines that are not perpendicular.
4. Construct an arc with radius of 1 inch and tangent to both lines in each intersecting set.
5. Find and mark all points of tangency.
6. Have your construction evaluated.

Principal Author(s): C. Wetterling

File Code: 79.01.03.20:A2-0

Date Published: 11/6/75
Date Revised: 8-16-79

Mountain-Plains Education &
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Glasgow AFB, Montana 59231

Learning Activity Package

Student: ____________________

Date: ____________________

PERFORMANCE ACTIVITY: Constructing an Arc Tangent to Two Arcs

OBJECTIVE:

Construct an arc tangent to two given arcs. (2 Cases)

EVALUATION PROCEDURE:

Instructor will evaluate for accuracy and construction method with no errors allowed.

Successful completion of this LAP is determined by correctly answering 8 out of 10 items on a multiple-choice test that is combiend with "Applying Techniques of Geometric Construction" LAP test and is taken after completing that LAP.

RESOURCES:

Basic Technical Drawing, pg. 75 (Fig. 5-19)
Engineering Drawing and Graphic Technology, pg. 67, para. 16
Technical Drawing, pp. 104 & 105 (Figures 4.40 & 4.41)

Basic Drafting Tools: (See Unit LEG)
Drafting Furniture: (See Unit LEG)

PROCEDURE:

1. Read the above resource(s).
2. Case I - On the back of this sheet, draw two circles a short distance apart:

   One, with a radius of 1 inch.

   Second, with 3/4 inch radius.
3. Construct an arc with a 2 inch radius that is tangent to both circles.
4. Find all points of tangency.
5. Case II - Draw two circles the same size as Case I, with 2 inches between centers.
6. Construct an arc with a 4 inch radius tangent to both given circles. Mark the tangency points.
7. Have the construction evaluated.

Principal Author(s): C. Wetterling
Revised by: S. Vosen, J. Wheatley

File Code: 79.01.03.21:A2-0

Date Published: 11-6-75

Revised: 8-16-79

Mountain-Plains Education &
Economic Development
Program, Inc.
Glasgow AFB, Montana 59231

Learning Activity Package

Student: ____________________

Date: ____________________

PERFORMANCE ACTIVITY: Trammel, Concentric Circle, and Compass Method of Ellipse Construction

OBJECTIVE:

Draw an ellipse using the trammel method.
Draw an ellipse using the concentric circle method.
Draw an ellipse using the compass (4 center) method.

EVALUATION PROCEDURE:

Instructor will evaluate for accuracy and construction method with no errors allowed.

Successful completion of this LAP is determined by correctly answering 8 out of 10 items on a multiple-choice test that is combined with "Applying Techniques of Geometric Construction" LAP test and is taken after completing that LAP.

RESOURCES:

Basic Technical Drawing, pg. 76 (Fig. 5-21, 5-22 and 5-23)
Basic Drafting Tools: (see Unit LEG)
Drafting Furniture: (see Unit LEG)

PROCEDURE:

1. Read the above resource(s).
2. On the back of this sheet, draw a horizontal line 3 inches long, construct a perpendicular bisector to this line.
3. Using the trammel method, construct an ellipse with a major axis of 3" and a minor axis of 2".
4. Construct an ellipse with a 4" major axis and a 2" minor axis using the concentric circle method.
5. Construct an ellipse with a 4" major axis and a 1 3/4" minor axis using the compass (4 point) method.
6. Have your constructions evaluated.

Principal Author(s): C. Wetterling, J. Wheatley

File Code: 79.01.03.22:A2-0

Date Published: 2-16-75

Revised: 8-16-79

Mountain-Plains Education &
Economic Development
Program, Inc.
Glasgow AFB, Montana 59231

Learning Activity Package

Student: ______________________

Date: ______________________

PERFORMANCE ACTIVITY: Applying Techniques of Geometric Construction

OBJECTIVE:

Draw two objects applying the techniques of geometric construction.

EVALUATION PROCEDURE:

The instructor will examine the drawings for accuracy and proper construction techniques. Three errors will be allowed.

Successful completion of this LAP is determined by correctly answering 8 out of 10 items on a multiple-choice test.

RESOURCES:

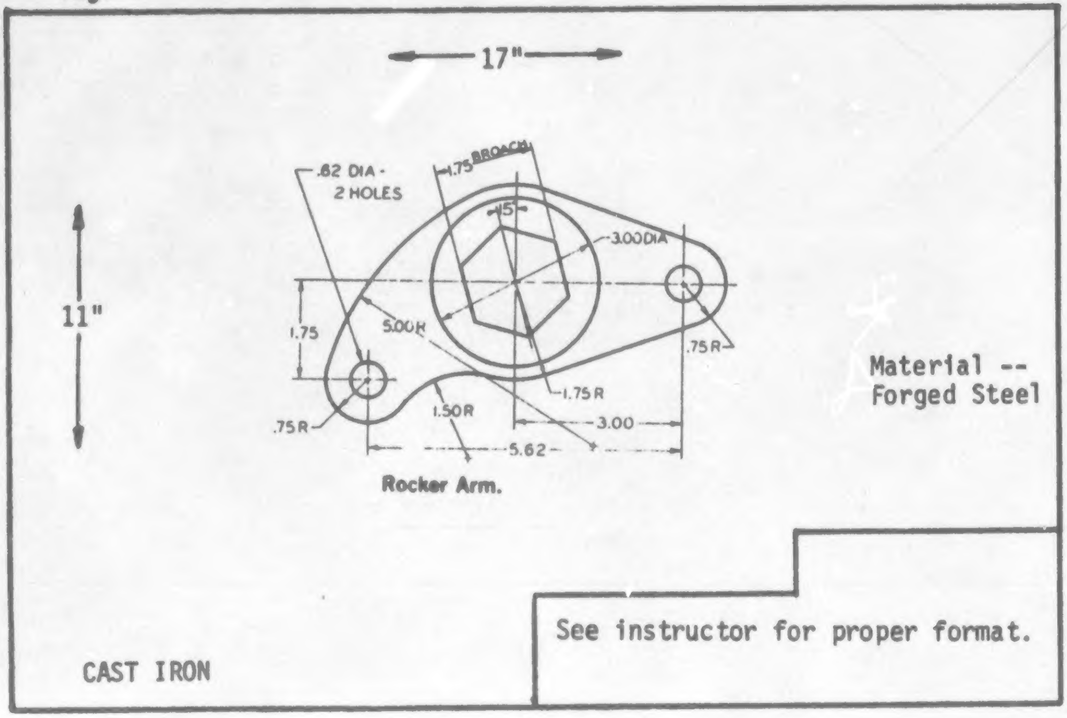
Previous LAPs
Basic Technical Drawing, Chapter 5.
Technical Drawing, Chapter 4.
Engineering Drawing and Graphic Technology, Chapter 3.
Basic Drafting Tools: (see Unit LEG)

PROCEDURE:

1. Draw a border and title block in ink with the ruling pen using the format given in this LAP.
2. Draw the two problems given in this LAP using techniques of geometric construction. Make sure the drawings are centered.

   NOTE: Use a sheet of 12" x 18" drawing paper for these two drawings.
3. Identify all points of tangency.
4. When completed, have the instructor evaluate the drawings.
5. Take the LAP test.

Principal Author(s): C. Wetterling, S. Vosen, J. Wheatley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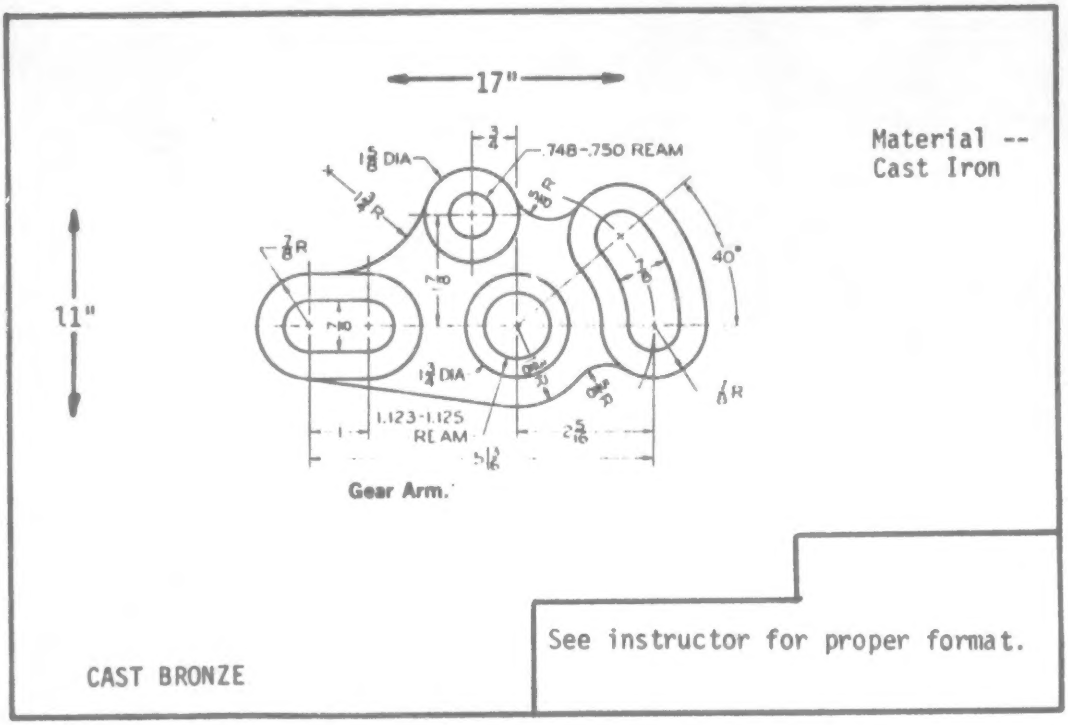
1.75 BROACH
15°
3.00 DIA
1.75
5.00 R
.75 R
1.75 R
1.50 R
.75 R
3.00
5.62

Rocker Arm.

Material -- Forged Steel

See instructor for proper format.

CAST IRON


17"
11"
1 5/8 DIA
3/4
.748-.750 REAM
1 3/4 R
7/8 R
40°
1 3/4 DIA
1.123-1.125 REAM
1
2 5/16
5 13/16

Gear Arm.

Material -- Cast Iron

See instructor for proper format.

CAST BRONZE

Student: ______________________ File Code: 79.01.03.23.A2-2 .06-.08& .15-.24

Date: ______________________ Date Published: 3/2/78

Revised

6 Lap 06407

Mountain-Plains Education &
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Glasgow AFB, Montana 59231

LAP TEST: (GEOMETRIC CONSTRUCTION)
COMBINED LAPS

1. The side of a right triangle that is opposite the right angle is:

   a. the secant.
   b. the chord.
   c. the hypotenuse.
   d. the isosceles.

2. Arcs having the same center are said to be:

   a. concentric.
   b. scalene.
   c. secant.
   d. chorded.

3. An equilateral triangle has:

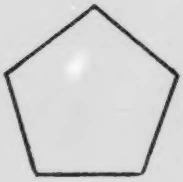
   a. a 90 degree angle.
   b. three sides unequal.
   c. three sides equal.
   d. at least one 75 degree angle.

4. The construction shown below is a solution to the problem of:

   a. constructing an equilateral triangle.
   b. constructing a right triangle from three given sides.
   c. constructing a perpendicular to line AB.
   d. bisecting line AB.

5. The object shown at right is:

   a. an octagon.
   b. a pentagon.
   c. a decagon.
   d. a hexagon.

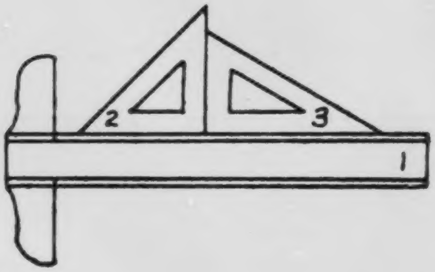


6. A hexagon has:

   a. five sides.
   b. six sides.
   c. 1/8"
   d. eight sides.

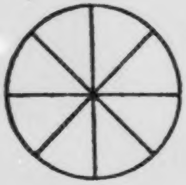
7. The combination of instruments shown below that are used to construct a hexagon is:

   a. 1 and 2.
   b. 2 and 3.
   c. 1 and 3.
   d. 1 and 2 and 3.



8. The sketch shown below is preliminary to the sketching of:

   a. a pentagon.
   b. a nonagon.
   c. a octagon.
   d. a hexagon.



9. To lay off the approximate length of an arc, use:

   a. dividers.
   b. the T-square.
   c. an ellipse template.
   d. ruling pen.

10. To draw a circle through three given parts:

   a. use one of the given points as a center.
   b. construct perpendicular bisectors of two chords of the arc.
   c. lay off the length of the arc first.
   d. draw a right polygon with the points at the corners.

LAP TEST ANSWER KEY: COMBINED LAPS (GEOMETRIC CONSTRUCTION)

1. C
2. A
3. C
4. A
5. B
6. B
7. C
8. C
9. A
10. B

Student: ____________________ File Code: 79.01.03.32.A2-2 .25- .32

Date: ____________________ Date Published: 6/20/74

Date Revised: 3/3/78

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LAP TEST: COMBINED LAPS (GEOMETRIC CONSTRUCTION)

1. To find the tangency point of two circles, draw:

   a. a straight line connecting the circle centers.
   b. a perpendicular to the arcs.
   c. a straight line parallel to the plane of intersection.
   d. an arc with radius of R + R1.

2. To find the tangency point of a straight line and a circle, draw:

   a. a perpendicular to the straight line from the circle center.
   b. a straight line parallel to the given line.
   c. an arc with radius R and its center on the straight line.
   d. an arc with radius of R + R1.

3. To obtain a smooth joint between tangent lines:

   a. terminate the lines at the point of tangency.
   b. overlap the lines slightly.
   c. draw one of the lines just short of the point of tangency.
   d. draw both lines short of the point of tangency and then fill it in.

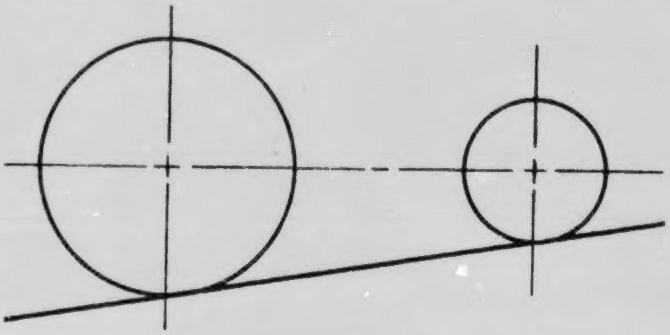
4. To construct an arc tangent to a line, and passing thru a given point; you would:

   a. draw a perpendicular from the point to the line and use it for the center of the arc.
   b. construct a line parallel to the given line and radius of the arc from it, then swing the arc from the given point. Where they intersect is the center of the arc.
   c. swing an arc of given radius from both the line and the point. Where they intersect is the center.
   d. there is no way to construct this figure.

5. To construct an arc tangent to two intersecting lines, you would:

   a. bisect the angle and measure the radius of the arc out from the vertex.
   b. step of the radius on each leg of the angle, then swing the radius from these points. Where they intersect is the center of the arc.
   c. construct 2 lines parallel to the given lines, the radius of the arc away from the given lines. Where they intersect is the center of the tangent arc.
   d. none of the methods listed above work.

6. Referring to the construction below, what is the correct geometric method of making a line tangent to two arcs?



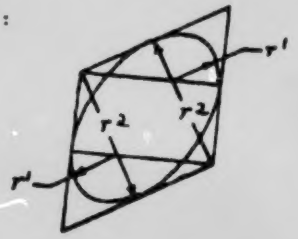
   a. there is no correct geometric method.
   b. swing 2 arcs from the center of the given circles.
   c. construct a perpendicular from the line to the center of the circle.
   d. bisect the distance between the two arcs and construct a radius from the line.

7. An ellipse is a geometric figure with:

   a. one center and all points equidistant from that center.
   b. a variable center axis.
   c. a major and minor diameter which may vary.
   d. two center and all points equidistant from both centers.

8. The method of drawing an ellipse shown at right is:

   a. the concentric circle method.
   b. the trammel method.
   c. the axis method.
   d. the approximate four-center method.



9. The easiest and fastest method to draw an ellipse is:

   a. with a template.
   b. by the 4 center method.
   c. by the concentric circle method.
   d. by the trammel method.

10. The first lines to ink on a drawing are:

   a. circles and arcs.
   b. horizontal lines.
   c. vertical lines.
   d. border lines.

79.01.03.32.A2-2
.25- .32

LAP TEST ANSWER KEY: COMBINED LAPS (GEOMETRIC CONSTRUCTION)

1. A
2. A
3. A
4. B
5. C
6. A
7. C
8. D
9. A
10. A

Student: ______________________ File Code: 79.01.03.00.A1-5

Date: ______________________ Date Published: 11/6/74

Date Revised: 8-16-79

Mountain-Plains Education &
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UNIT PERFORMANCE TEST: GEOMETRIC CONSTRUCTION

OBJECTIVE 1:

Given an illustration of an object, the student will be able to construct the object using correct geometric construction techniques.

OBJECTIVE 2:

The student will be able to properly ink the border and title block.

OBJECTIVE 3:

The student will be able to geometrically construct an object that is properly centered, neat, and accurate to the given dimensions.

OBJECTIVE 4:

The student will be able to draw lines, arcs, and circles that are:

(a) Neat
(b) Properly drawn
(c) Weighted to appropriate contrasts

OBJECTIVE 5:

The student will be able to geometrically locate all points of tangency.

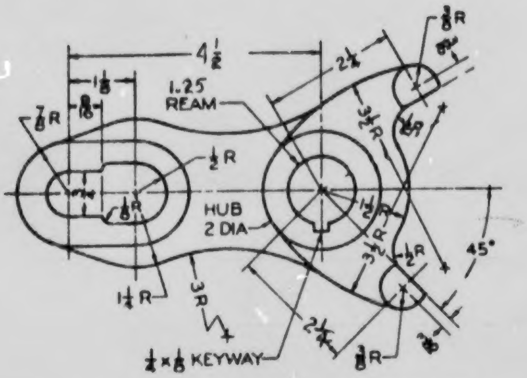
TASK:

Using the given dimensions, the student will make a finished drawing of an assigned illustration.

ASSIGNMENT:

Using a sheet of 12" x 18" drawing paper, the student will reproduce the form roll lever shown on Page 2.

ASSIGNMENT:


4 1/2
1 1/8
9/16
7/8 R
1.25 REAM
1/2 R
1/8 R
HUB 2 DIA
1 1/4 R
3R
1/4 × 1/8 KEYWAY
2 1/4
3 1/2 R
3/8 R
1/2 R
1 1/2 R
3 1/2 R
1/2 R
45°
2 1/4
3/8 R

Form Roll Lever. CAST STEEL

CONDITIONS:

The drawing is to be completed in a typical drafting room setting, using the complete facilities.

The student will not be able to use the instructor(s) or other students as a resource.

RESOURCES:

Drawing set
Ames lettering guide
30 x 60 triangle
45 x 45 triangle
Architects scale
Engineer scale
Brush
Lead holder
Lead pointer
Erasing shield
Rapido graph pen set
Drafting table
Drafting board
"T" square
Stool
Eraser
Leads (Soft/Med/Hard)
Tape
Drawing paper
India ink
Electric Eraser
Protractor
Technical Drawing, Giesecke/Mitchell/Spencer/Hill
Mechanical Drawing, French and Svenson
Engineering Drawing and Graphic Technology, French and Vierck

Student: ______________________________ File Code: 79.01.03.00.A1-5

Date: ______________________________ Date Published: 11/6/74

Date Revised: 8-16-79

Mountain-Plains Education &
Economic Development
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Glasgow AFB, Montana 59231

PERFORMANCE CHECKLIST: GEOMETRIC CONSTRUCTION

OVERALL PERFORMANCE: Satisfactory_____ Unsatisfactory_____

	CRITERION	
	Met	Not Met
Objective 1:		
1. Uses correct geometric construction techniques.		
Criterion: All lines meet and all angles are accurate to within 1°.		
Objective 2:		
2. Border and title-block are inked correctly.		
Criterion: Border will be inked, using Rapidograph pen #2, and Leroy Template #175. Border line spacing will be 1/2". Three part title block spacing will be 5" in length with 5/16" spacing. Four part will be 5" in length with 7/16" spacing.		
Objective 3:		
3. Drawing is clean and neat.		
Criterion: (ASA Standards), Technical Drawing, p. 12-22		
4. Drawing is centered.		
Criterion: (ASA Standards)		

(Checklist continued)

	CRITERION	
	Met	Not Met
5. Total drawing is accurate to given dimensions		
Criterion: plus or minus 1/64"; plus or minus 1^{0}		
Objective 4:		
6. Visible lines are neat and properly drawn		
Criterion: (ASA Standards), Technical Drawing, p. 20		
7. Center lines are neat and properly drawn		
Criterion: (ASA Standards), Technical Drawing, p. 20		
8. Visible lines are of appropriate contrast in relation to the other lines.		
Criterion: (ASA Standards), Technical Drawing, p. 20		
9. Center lines are of appropriate contrast in relation to other lines.		
Criterion: (ASA Standards), Technical Drawing, p. 20		
Objective 5:		
10. All points of tangency are marked and are correct		
Criterion: No points of tangency are left unmarked		
11. The drawing is completed in specified time limits.		
Criterion: Not to exceed 5 hours		
Student must meet criterion on 8 line items to obtain an overall score of satisfactory.		

Student: ______________________ File Code: 79.01.03.00. B2-2

Date: ______________________ Date Published: 6/20/74

Mountain-Plains Education &
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Glasgow AFB, Montana 59231

UNIT POST TEST: GEOMETRIC CONSTRUCTION

79.01.03.02.

1. Bisect means divide into:

   a. two equal parts.
   b. two parts.
   c. three equal parts.
   d. three parts.

2. To intersect means to:

   a. cut across.
   b. divide into two equal parts.
   c. use a compass on it.
   d. use dividers.

79.01.03.03.

3. A diagonal is:

   a. a line passing through the center of a sphere.
   b. a line through two points on an arc.
   c. a line from corner-to-corner in a figure.
   d. another name for a diameter.

4. An inscribed regular polygon is:

   a. an oblique cone.
   b. drawn outside of a circle.
   c. drawn inside of a circle.
   d. a right hexahedron.

5. A circumscribed regular polygon is:

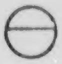
   a. a secant.
   b. drawn inside of a circle.
   c. drawn around a circle.
   d. cut off on one end not parallel to the base.

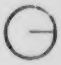
79.01.03.04.

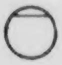
6. The interior angles of any triangle total up to:

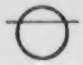
   a. more than 0 degrees but less than 90 degrees.
   b. 90 degrees.
   c. 180 degrees.
   d. more than 90 degrees but less than 180 degrees.

7. An example of a radius is:

   a. 

   b. 

   c. 

   d. 

79.01.03.05.

8. An angle measuring less than 90 degrees is said to be:

   a. acute.
   b. obtuse.
   c. scalene.
   d. isosceles.

9. The leg or side of a triangle from which the height is measured is:

   a. the vertex.
   b. the base.
   c. the secant.
   d. the scalene.

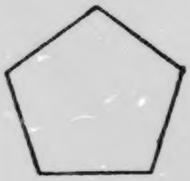
10. A triangle with three sides equal and three angles equal is:

   a. obtuse.
   b. equilateral.
   c. isosceles.
   d. scalene.

79.01.03.15,16.

11. The object shown below is:

    a. an octagon.
    b. a pentagon.
    c. a decagon.
    d. a hexagon.



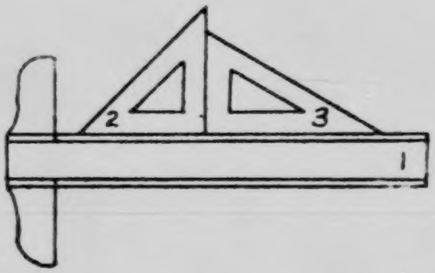
79.01.03.17,18,19.

12. A hexagon has:

    a. five sides.
    b. six sides.
    c. 1/8".
    d. eight sides.

13. The combination of instruments shown below that are used to construct a hexagon is:

    a. 1 and 2.
    b. 2 and 3.
    c. 1 and 3.
    d. 1 and 2 and 3.



79.01.03.20,21,22.

14. To lay off the approximate length of an arc, use:

    a. dividers.
    b. the T-square.
    c. an ellipse template.
    d. ruling pen.

79.01.03.24.

15. To draw a circle through three given points:

    a. use one of the given points as a center.
    b. construct perpendicular bisectors of two chords of the arc.
    c. lay off the length of the arc first.
    d. draw a right polygon with the points at the corners.

79.01.03.25,26,27,28.

16. To find the tangent point of a straight line and a circle, draw:

    a. a perpendicular to the straight line that passes through the circle center.
    b. a straight line parallel to the given line.
    c. an arc with radius R and its center on the straight line.
    d. an arc with radius of R + R1.

17. When drawing tangencies on an ink tracing, draw:

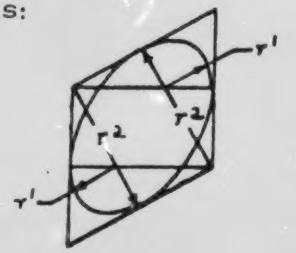
    a. all the curved lines first.
    b. all the straight lines first.
    c. construction lines heavy and dark so they can be seen easily.
    d. the tangent lines in pencil on the tracing, then ink over the pencil.

18. When tracing tangencies in ink, it helps to:

    a. mark the points of tangency with a pencil.
    b. mark the points of tangency with a pen.
    c. not mark the points of tangency.
    d. rub pounce into the pencil copy of the tangencies.

79.01.03.29,30,31.

19. The method of drawing an ellipse shown below is:



a. the concentric circle method.
b. the trammel method.
c. the axis method.
d. the approximate four-center method.

79.01.03.32.

20. When corrections are needed on a pencil drawing that is to be inked:

a. make the corrections in pencil before inking.
b. make the corrections in ink as you come to them.
c. make the ink copy, mark the errors and redraw it.
d. make the ink copy, then erase and correct errors.

UNIT POST TEST ANSWER KEY: GEOMETRIC CONSTRUCTION

LAP		
02	1.	A
	2.	A
03	3.	C
	4.	C
	5.	C
04	6.	C
	7.	B
05	8.	A
	9.	B
	10.	B
06-24	11.	B
	12.	B
	13.	C
	14.	A
	15.	B
25-32	16.	A
	17.	D
	18.	A
	19.	D
	20.	A

Family Education Program

File Code: 79.01.04.00.A2-1

Date Published: 10-24-79

Learning Experience Guide

UNIT: SHAPE DESCRIPTION

RATIONALE:

A drawing is a form of non-verbal communication. In order to draw an object, we need to understand its shape. This shape may be described in either an orthographic or isometric drawing. A thorough understanding of each method helps develop the ability to visualize the object and simplify the drawing process.

PREREQUISITES:

Unit: 79.01.03 -- Geometric Construction

OBJECTIVES:

Apply various orthographic and isometric lettering, numbering and projection techniques to the sketching and drawing of given objects. Add missing lines and views to incomplete orthographic drawings.

PRINTED MATERIALS

Basic Technical Drawing. Spencer and Drydon, MacMillan Company, New York, 1968.
Engineering Drawing and Graphic Technology. French and Vierck, Eleventh Edition, McGraw-Hill Book Company, New York, 1973
Mechanical Drawing. French and Svenson, Webster Division, McGraw-Hill Book Company, New York, 1968.
Technical Drawing. Gieseche, Mitchell, Spencer and Hill, Sixth Edition, MacMillan Company, New York, 1974.
Drafting Rules and Principles. Howard C. Nelson, McKnight and McKnight, Bloomington, Ill., 1958.
Design Drafting. Earle, Addison-Wesley Publishing, London.

AUDIO/VISUALS

Drafting Series (Shape Description) -- Doubleday Media
Video Cassette for Unit 4.

EQUIPMENT

See Course LEG.

Principal Author(s): S. Vosen, J. Wheatley

GENERAL INSTRUCTIONS:

This unit consists of six Learning Activity Packages (LAPs). Each LAP will provide specific information for completion of a learning activity. The general procedure for this unit is as folows:

1. Read the first assigned Learning Activity Package (LAP).
2. Begin and complete the first assigned LAP.
3. Have the drawing checked and approved by the instructor.
4. Take the LAP tests where indicated.
5. Proceed to and complete the next assigned LAP for this unit.
6. Complete all required LAPs for the unit for following Steps 3 and 4.
7. Take the unit post and performance tests as described in the unit LEG "Evaluation Procedures".
8. Proceed to the next assigned unit.

PERFORMANCE ACTIVITIES:

.01 Introduction to orthographic drawing: top, front, and right side views.
.02 Projection with a 45^0 miter line.
.03 Projections using a dividers.
.04 Sketching missing lines -- visible and hidden.
.05 Isometric sketch and drawing of rectangular objects.
.06 Isometric drawings of cylindrical objects and objects with major holes and/or curves.

EVALUATION PROCEDURE:

1. Upon completion of the LAPs the student takes a unit performance test.
2. The student then takes a multiple-choice post test and turns it in for correction. (Successful unit completion is meeting the listed criteria for the performance test and obtaining at least 80% on the unit post test.

FOLLOW-THROUGH:

The skill of visualization will be used for the construction of multi-view drawings throughout the course. This skill will be monitored as the student works on future drawings.

Go to the first assigned Learning Activity Package (LAP) listed on your Student Progress Record (SPR).

Student: ______________________ **File Code:** 79.01.04.00

Date: ______________________ **Date Published:** 1-30-79

Revised; 11-14-79

Family Education Program

PERFORMANCE TEST: SHAPE DESCRIPTION

OBJECTIVE 1:

Given two isometric objects, the student will be able to make an orthographic sketch and an orthographic drawing of the objects to required scale.

OBJECTIVE 2:

Given two orthographic objects, the student will be able to make an isometric sketch and an isometric drawing of the objects to approximate scale.

TASK:

1. The student will make an orthographic sketch from dimensioned isometric sketch #1. Use size "B" drawing paper. Divide sheet into four equal rectangles. Do not use border or title block. Scale = Full.
2. The student will make an orthographic drawing from dimensioned isometric drawing #2. Center your drawing in one rectangle. Scale: 1" = 1½".
3. The student will make an isometric sketch from dimensioned orthographic sketch #3, using appropriate sketching conventions from Chapters 2 and 16, Basic Drawing. Sketch is to be double in size.
4. The student will make an isometric drawing from dimensioned orthographic drawing #4. Scale = Double.

ASSIGNMENT:

See attached illustration. Space drawings evenly on size "B" drawing paper. No border or title block necessary.

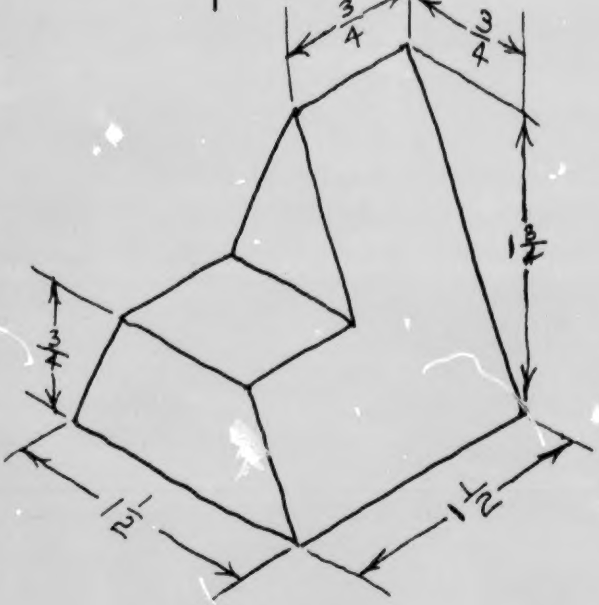
CONDITIONS:

The drawing is to be completed in a typical drafting room setting, using the complete facilities. The student will not be able to use the instructor(s) or other students as a resource.

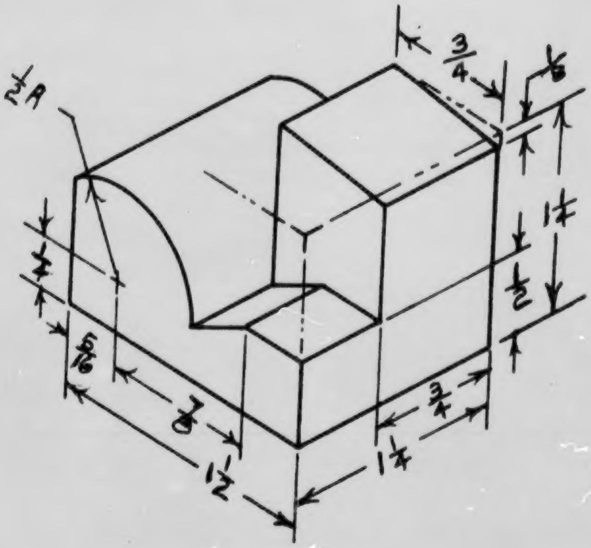
RESOURCES:

As listed in Unit LEG.

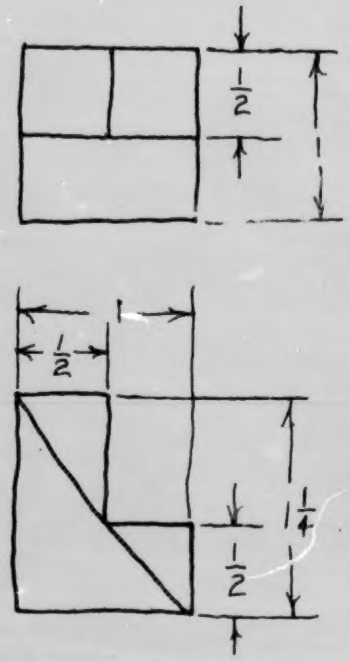
#1


3/4
3/4
1 3/4
3/4
1 1/2
1 1/2

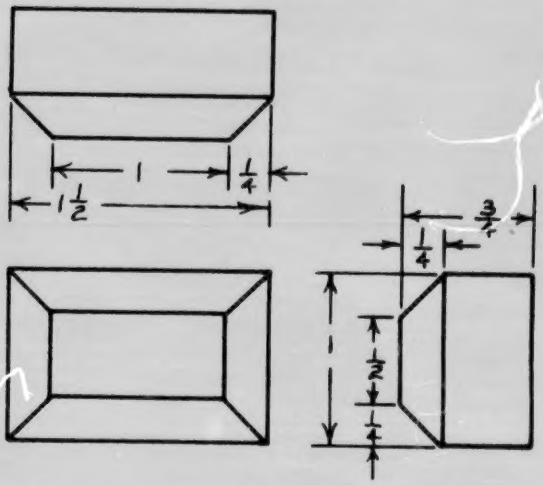
#2


1/2 R
3/4
1/8
1 1/4
1/2
1/4
5/16
7/8
1 1/2
1 1/4
3/4

#3


1/2
1/2
1 1/4
1/2

#4


1
1/4
1 1/2
3/4
1/4
1/2
1/4

Student: ____________________ File Code: 79.01.04.00.A1-5

Date: ____________________ Date Published: 1-30-79

Revised: 11-14-79

Family Education Program

PERFORMANCE CHECKLIST:

OVERALL PERFORMANCE: Satisfactory _____ Unsatisfactory _____

	CRITERION Met	 Not Met
Objective 1:		
1. All lines from the isometric objects are drawn on the orthographic sketch and drawing.		
Criterion; All lines filled in as per instructor key.		
2. All lines are accurate on the orthographic drawing.		
Criterion: ± 1/64 of an inch and 1° for angles.		
Objective 2:		
3. Isometric drawing is an accurate representation of the orthographic illustration.		
Criterion: All lines filled in as per instructor key.		
4. The isometric sketch is pictorially proportional to the orthographic illustration.		
Criterion: Proportion must be consistant.		
5. The drawing is completed in the specified time limit.		
Criterion: Not to exceed two (2) hours.		
The student must meet criterion on 4 line items to obtain an overall score of satisfactory.		

Student: ______________________ File Code: 79.01.04.00. A2-2 (.01-.06)

Date: ______________________ Date Published: 6/20/74

Mountain-Plains Education & Economic Development Program, Inc.
Glasgow AFB, Montana 59231

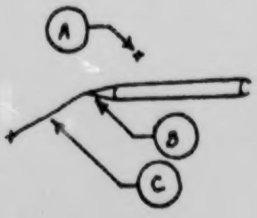
UNIT/LAP PRETEST: SHAPE DESCRIPTION

1. The most important consideration in sketching listed below is:

   a. exactness of measurements.
   b. quality of line work.
   c. straightness of lines.
   d. proportion of the object.

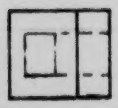
2. When first sketching a line as shown below, the eyes should be on:

   a. A the dot toward which the pencil is moving.
   b. B, the pencil point.
   c. C, the line which has been drawn.
   d. it makes no difference.

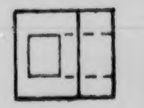


3. The right side view of the object shown below is: (Consider technique as well as correctness)

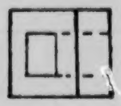
A



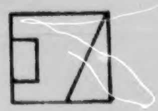
C

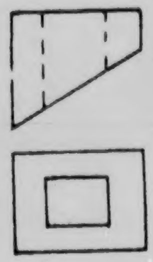


B



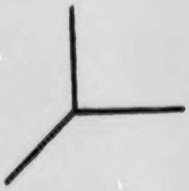
D



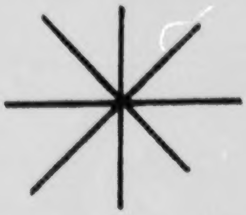


4. A sketch made according to the axis shown below would be:

   a. an orthographic sketch.
   b. an isometric sketch.
   c. a perspective sketch.
   d. an oblique sketch.



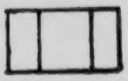
5. The lines shown below are often drawn to improve accuracy when sketching:



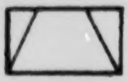
   a. a hexagon.
   b. a circle.
   c. a square
   d. a pentagon.

6. The top view of the object shown below should look like:

D



B



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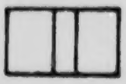
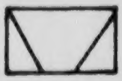
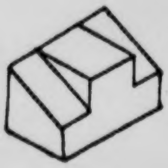


A





7. Most mechanical ideas are first shown in a:

   a. finished working drawing.
   b. complete blue print.
   c. text book.
   d. freehand sketch.

8. The type of lead to use for sketching is:

   a. 2B or 4B.
   b. H or 2H.
   c. 4H or 6H.
   d. HB or F.

9. The most important rule in freehand sketching is to:

    a. concentrate on line weight quality.
    b. make the sketch to an accurate scale.
    c. keep the sketch in proportion.
    d. be sure to erase all construction lines.

10. The three regular views in a sketch are:

    a. width, height, depth.
    b. top, front, leftside.
    c. top, front, rightside.
    d. elevator, plan, section.

78.01.04.00. A2-2
(.01-.06)

UNIT/LAP PRETEST ANSWER KEY: SHAPE DESCRIPTION

1. D
2. A
3. C
4. D
5. B
6. D
7. D
8. D
9. C
10. C

Family Education Program

File Code: 79.01.04.01 A2-0

Date Published: January 31, 1979
Revised: October 26, 1979

Learning Activity Package

Student: ____________________

Date: ____________________

PERFORMANCE ACTIVITY: Introduction to Orthographic Drawings: Top, Front, Right Side Views

OBJECTIVES:

1. Given an object and a glass box, draw the top, front and right side views as they appear on each plane of the box.
2. Given an isometric sketch, complete the required orthographic view in the area provided on the assigned sheets.

EVALUATION PROCEDURE:

Using a prepared key, the instructor will examine drawings to see if the drawings are correct. Students are expected to correct or repeat drawings until there are no errors.

RESOURCES:

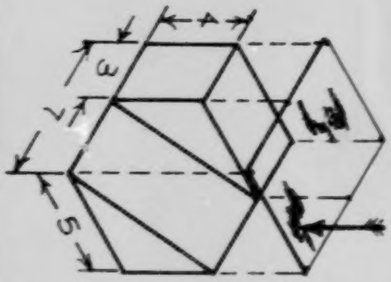
Design Drafting, Unit 7.
Basic Technical Drawing, Chapters 2, 6, and 7.
Technical Drawing, Chapter 6.
Basic Drafting Tools: (see unit LEG)
Drafting Furniture: (see unit LEG)
Audio/Visual Material: (see unit LEG)

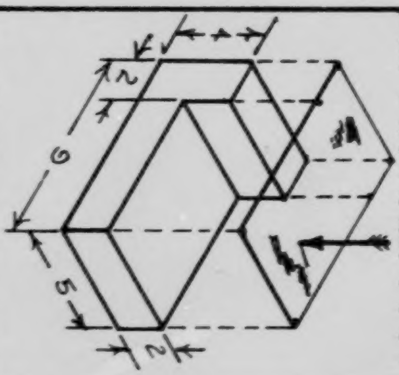
PROCEDURE:

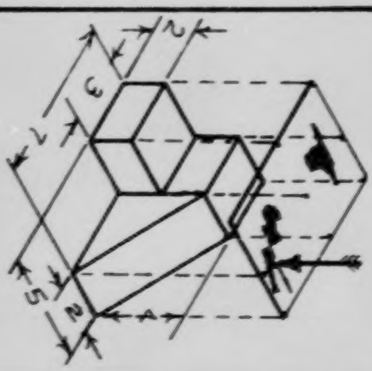
1. Read Resource(s) listed and view the filmstrips and video tape.
2. You are learning a new way of viewing "things" around you. Do not expect this skill to be developed overnight. Much practice and many exercises may be necessary before you can visualize a two dimensional view of the object. This skill will come easier if you practice. When you go home tonight, pick some objects and look at them from the top, front, and right side.
3. Obtain the "Glass Box" and felt marking pen from instructor.
   a. Choose two of the objects available. One object should have a curved surface, the other object should have an angled surface.
   b. Place one object in the glass box and draw top, front and right side of the object on the box planes of projection.
   c. Have drawing checked by instructor, then erase the marks on the box.
   d. Repeat the process with second object.
4. Work through the exercises on pages 2, 3, and 4.
5. Have the instructor check your work. Then take the LAP test and go on to LAP 2.

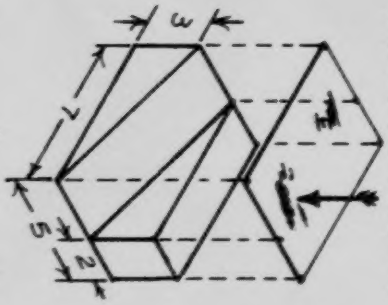
Principal Author(s): S. Vosen, J. Wheatley

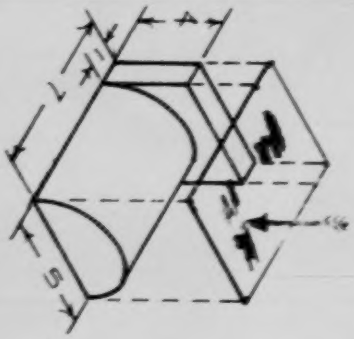
DIRECTIONS: Sketch the surface(s) of the object which you would see if you looked through the glass plane in the direction of the arrow (➛). Each square is equal to one inch. Which orthographic view are you drawing: ____________________?

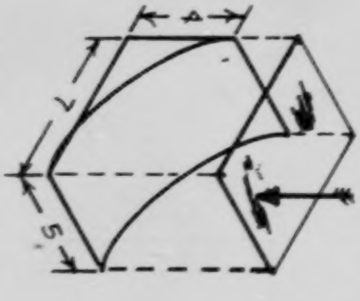


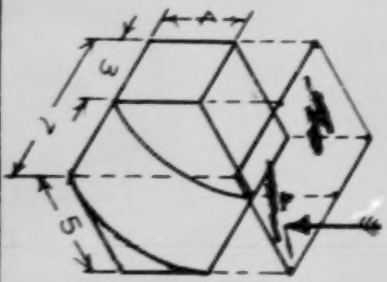


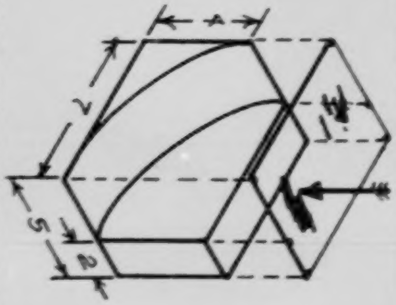




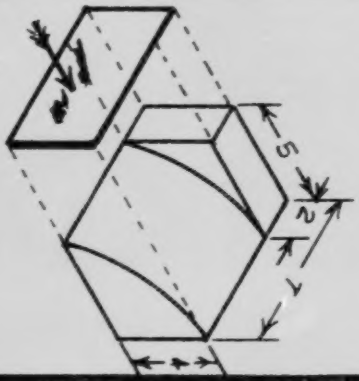


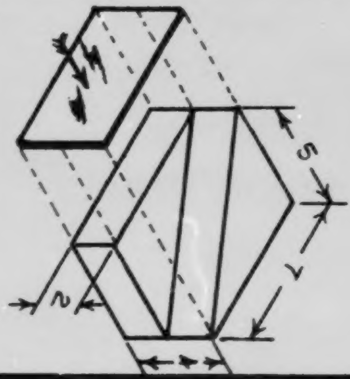


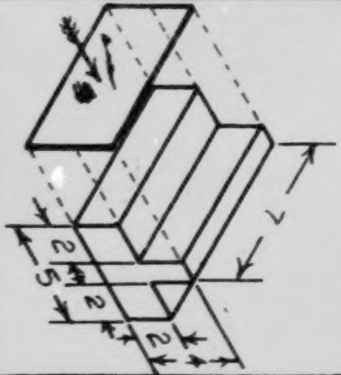


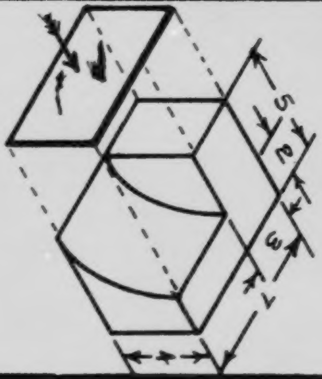


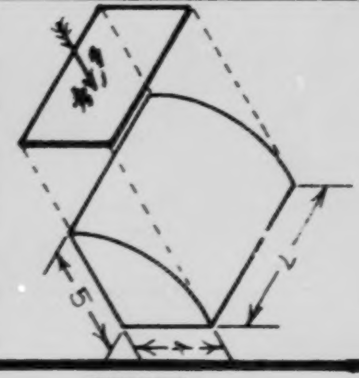
DIRECTIONS: Sketch the surface(s) of the object which you would see if you looked through the glass plane in the direction of the arrow (→). Each square is equal to one inch. Which orthographic view are you drawing: ____________________?

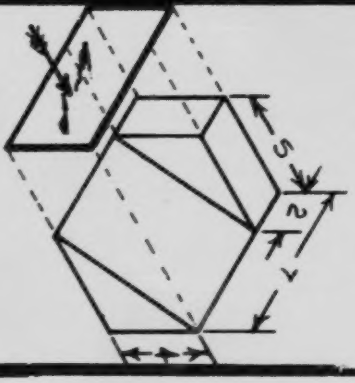


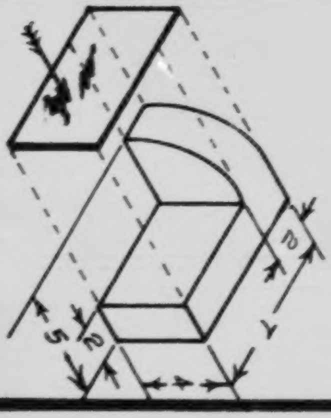


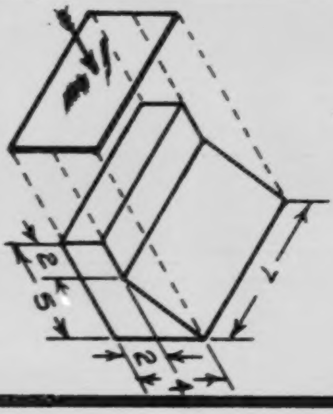




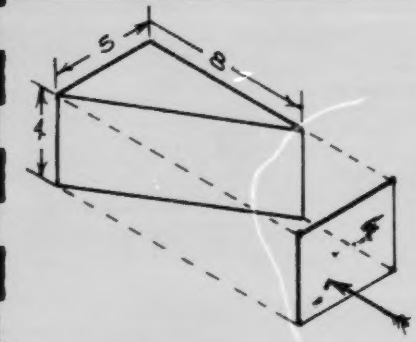


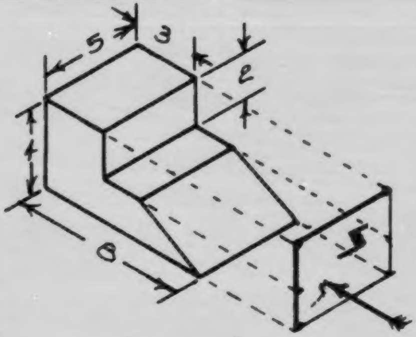


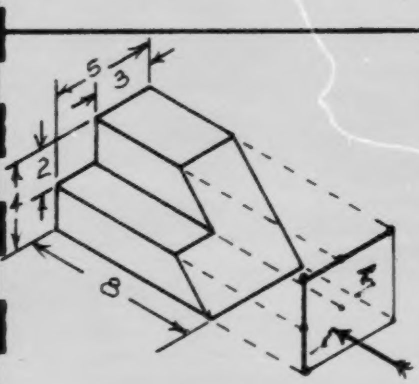


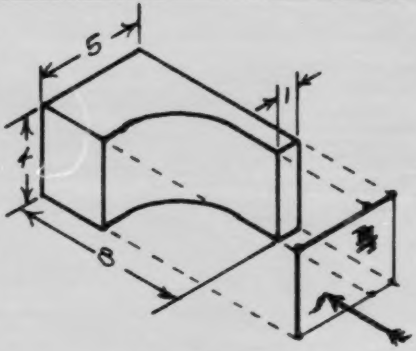


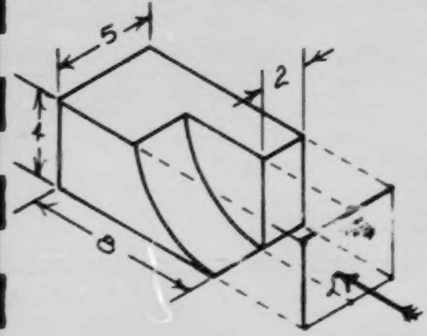
DIRECTIONS: Sketch the surface(s) of the object which you would see if you looked through the glass plane in the direction of the arrow (➾➞). Each square is equal to one inch. Which orthographic view are you drawing: ____________________________?

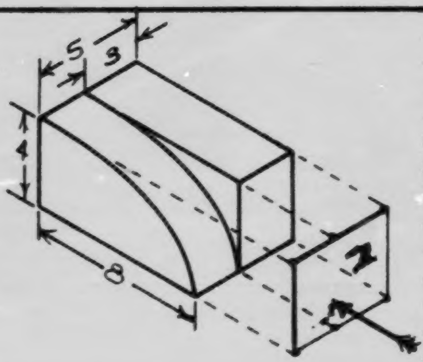


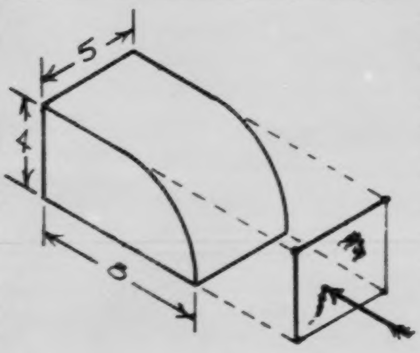


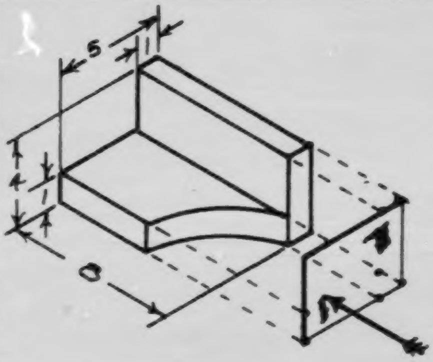












Student: ______________________ **File Code:** 79.01.04.01.A2-0

Date: ______________________ **Date Published:** 1/16/79
Revised: 2/21/80

Family Education Program

LAP TEST: INTRODUCTION TO ORTHOGRAPHIC PROJECTION -- TOP, FRONT, RIGHT SIDE VIEWS

1. Orthographic drawings and sketches:

   a. are normally shown as three views.
   b. require a back view if you have a left-side view.
   c. can be represented by only five views.
   d. according to drafting standards, you may not project the right-side view off of the edge of the top view.

2. The most commonly used lines of sight are:

   a. at any angle other than 90^0 to the front, top, or side of the object.
   b. perpendicular to the top, front, or right side of the object.
   c. directly at the outer corner of the object.
   d. so that you can see the three object dimensions at once.

3. Each standard plane of projection:

   a. has only one dimension in common with the view next to it.
   b. has two dimensions, each of which can be projected to the adjacent view.
   c. is at a 75^0 angle to the adjacent plane of projection.
   d. will give you all the dimensions you will need to locate the plane or planes seen in each view.

4. An angled plane surface will appear as:

   a. a line when you look perpendicular to it.
   b. its own shape in two views out of three.
   c. a line in the front view if it is a line in the top view.
   d. a point if viewed parallel to the surface of the plane.

5. A vertical or horizontal plane surface:

   a. will appear distorted in two of the three standard views.
   b. will appear as a surface in the top view if it is seen as a line in the right side view.
   c. will not appear as a hidden line mirror image in the view opposite to it.
   d. will appear as itself in one view only and as a line in the remaining two views.

LAP TEST ANSWER KEY:

INTRODUCTION TO ORTHOGRAPHIC PROJECTION
TOP, FRONT, RIGHT SIDE VIEWS

1. A

2. B

3. A

4. B

5. D

Family Education Program

File Code: 79.01.04.02: A2-0

Date Published: 1-30-79
Revised: 10-31-79

Learning Activity Package

Student: ____________________

Date: ____________________

PERFORMANCE ACTIVITY: Projection With A 45° Miter Line

OBJECTIVE:

Add missing views to various incomplete drawings, using the 45° projection line technique.

EVALUATION PROCEDURE:

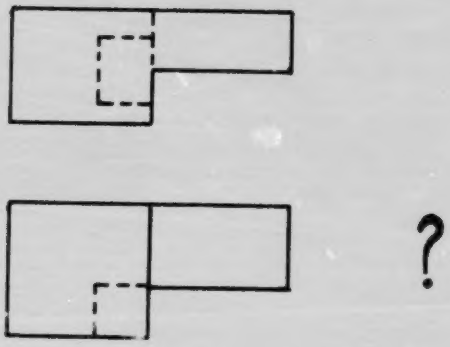
Instructor will examine drawings to see if all missing lines have been added. Student must have all drawings correct.

RESOURCES:

Basic Technical Drawing, Chapter 6 and Chapter 7
Design Drafting, Unit 7
Basic Drafting Tools: (see unit LEG)
Drafting Furniture: (see unit LEG)

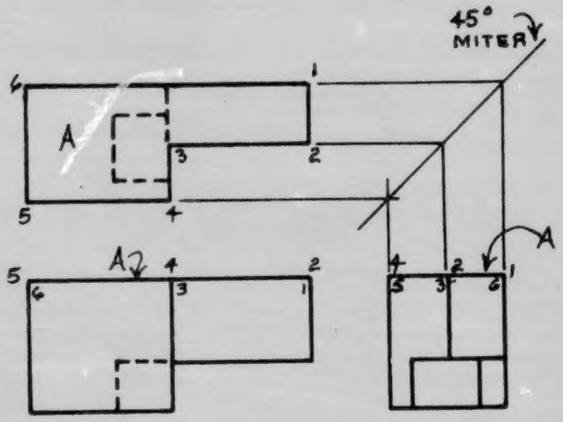
PROCEDURE:

1. Read Resource(s):



SAMPLE PROBLEM: Find the right side view of the object above by projecting from the two given views. (Review paragraph 7.11 and figures 7.13 and 7.14 in your Basic Technical Drawing. Review page 152, Design Drafting).

Principal Author(s): S. Vosen, J. Wheatley



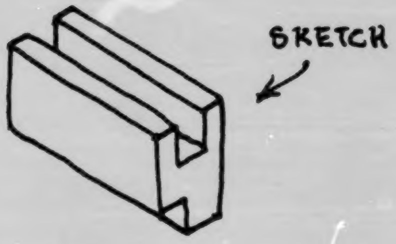
SOLUTION:

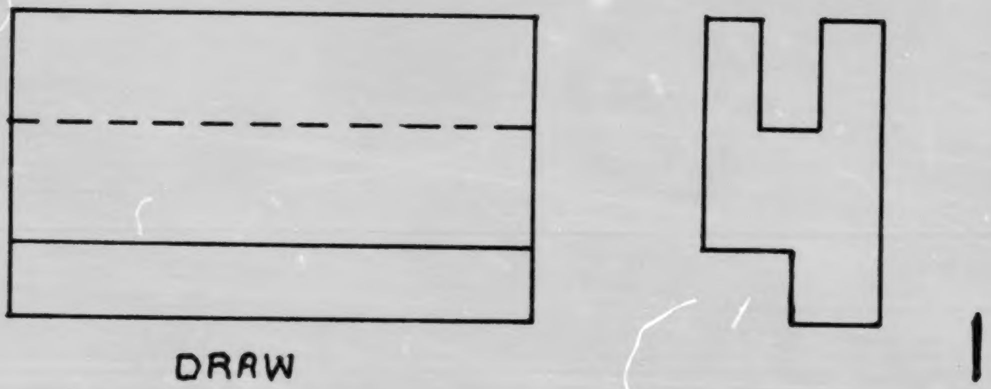
Step A: Since the top and right side view have depth in common, project this depth dimension to the 45° construction line and down to the side view.

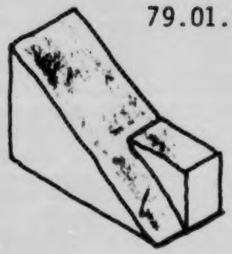
Step B: Project the width dimension from the top view to the front view. Project the height from the front view to the right side view.

Number surfaces of sketch 1 and sketch 2 on the following objects. You do not have to number object 3 or 4 if you can locate points without doing so.

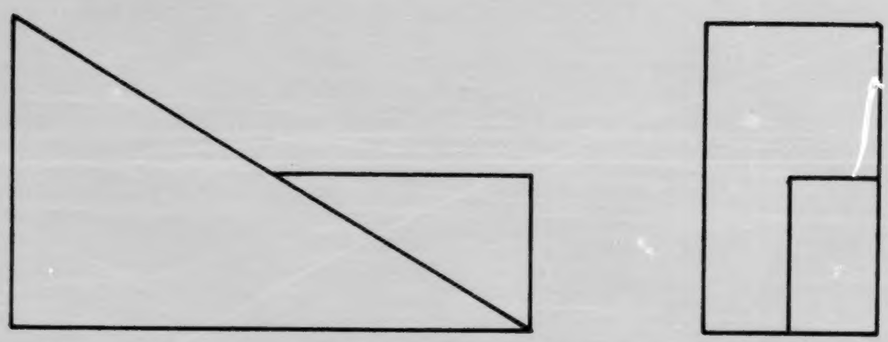
Transfer numbers and letters to all views using the 45° projection method and complete the missing view for each object.

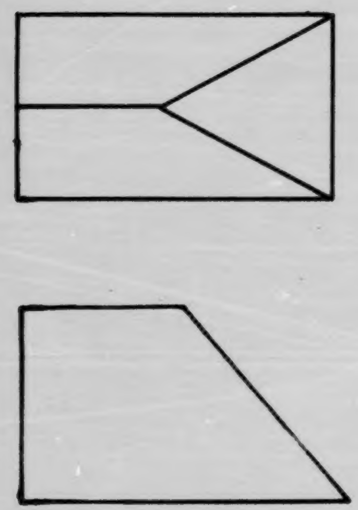






SKETCH ②





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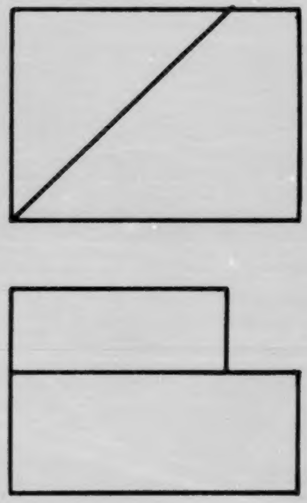

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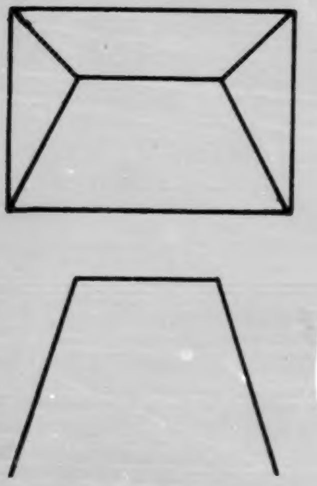

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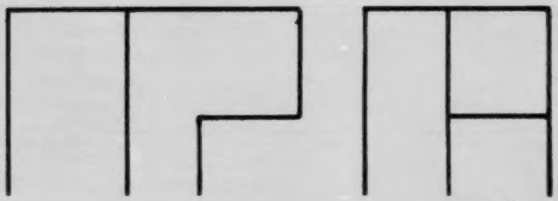


6

PROCEDURE: (continued)

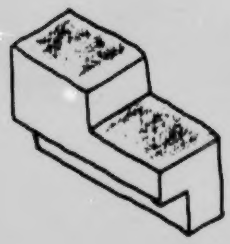
2. Using size "B" drawing paper and the 45^{o} projection method, draw three views of objects #3, 5, and 10 on page 98, objects #2, 7, 8, 9, 11, 12, 14, 16, and 19 on page 99 of Basic Technical Drawing. You will not use a border or title block on this drawing. The objects will all be drawn on one sheet of paper. Six on each side.

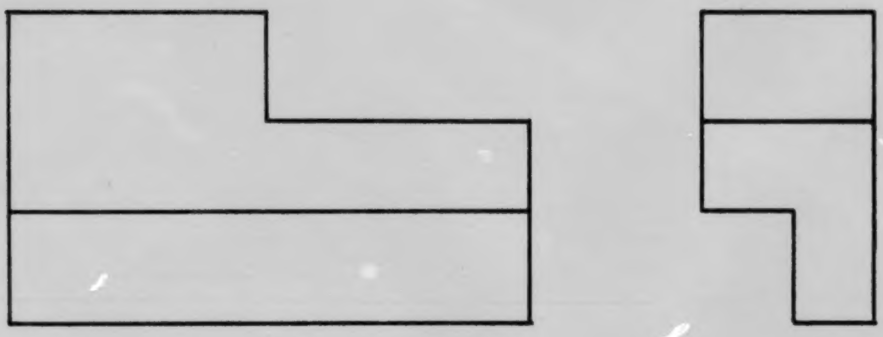
3. Take the LAP test before going on to the next LAP.

79.01.04.02
2-28-79
Supplemental Exercise

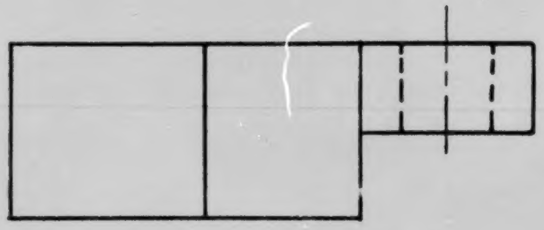
DIRECTIONS:

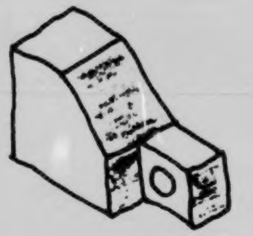
1. Letter all surfaces.
2. Number each surface as it appears in each view.
3. Project and transfer numbers to complete the missing view.

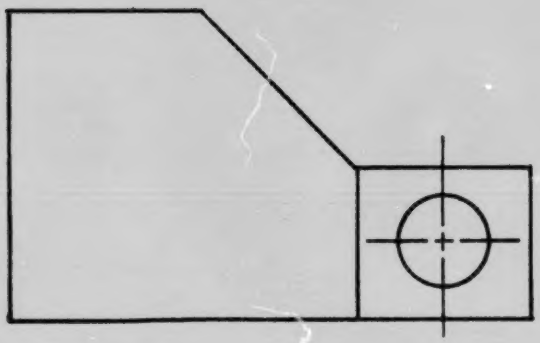




1







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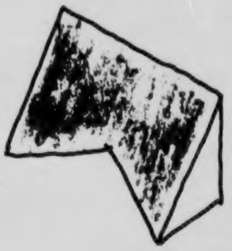

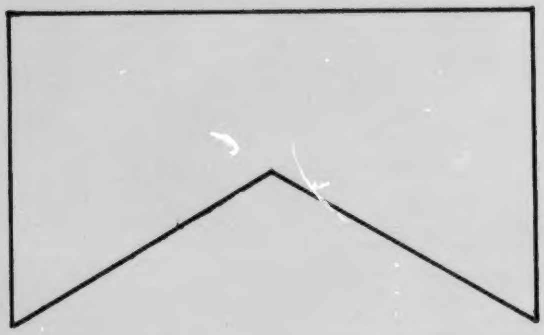

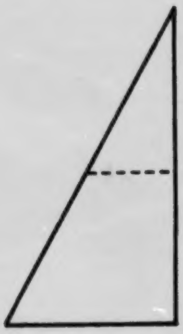

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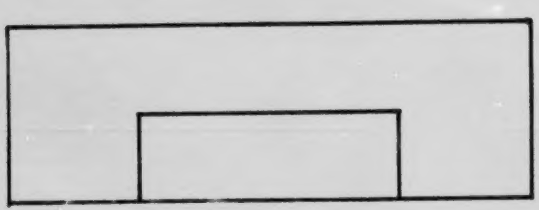

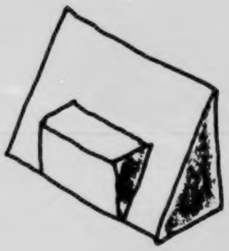

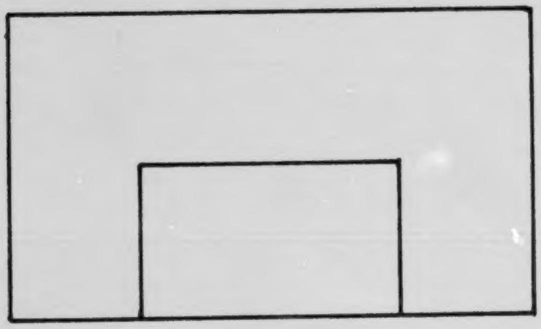

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Student: ____________________ **File Code:** 79.01.04.02.A2-0

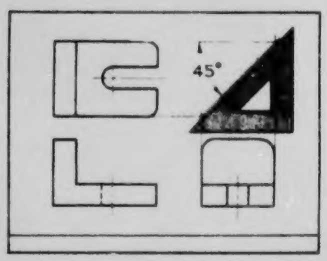
Date: ____________________ **Date Published:** 2/21/80

Family Education Program

LAP TEST: PROJECTION WITH 45° MITER

1. Which method below is the miter line method of projection?

a.



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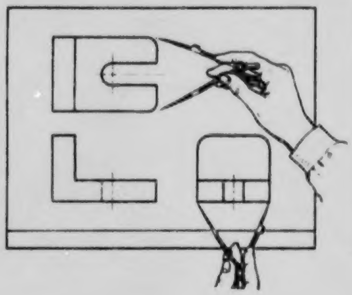

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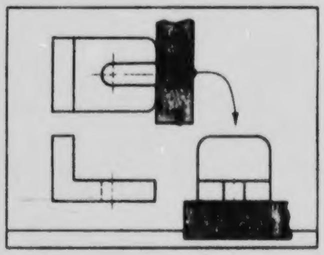
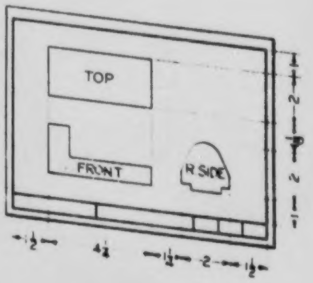


d.



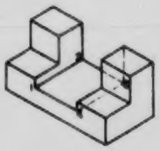
2. The 45° miter line projects which dimension?

   a. height
   b. width
   c. depth
   d. all the dimensions

3. In figure 1, the surface formed by numbers 1, 2, 3, & 4 is seen true size and shape in which view?

   a. top
   b. front
   c. right side
   d. all views

FIGURE 1



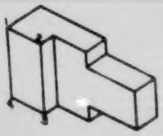
4. In figure 1, line 3-4 is a(n):

   a. height dimension
   b. width dimension
   c. depth dimension
   d. imaginary line

5. In figure 2, which numbers form depth dimensions?

   a. 1-2 & 4-3
   b. 3-2 & 4-1
   c. 4-2 & 3-1
   d. none of these

FIGURE 2



79.01.04.02.A2-0
2/21/80

LAP TEST ANSWER KEY

PROJECTION WITH 45° MITER

1. A
2. C
3. A
4. C
5. D

File Code: 79.01.04.03.A2-0

Date Published: 1-30-79
Revised: 11- 6-79

Family Education Program

Learning Activity Package

Student: ____________

Date: ____________

PERFORMANCE ACTIVITY: Projections Using a Dividers

OBJECTIVE:

Add missing views to various drawings by projecting from each view and transfering dimensions with a dividers.

EVALUATION PROCEDURE:

Instructor will examine drawings to see if all missing views have been added. Student must have all drawings correct.

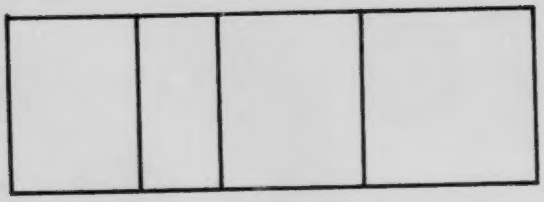
RESOURCES:

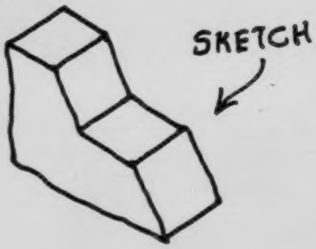
Basic Technical Drawing, Chapter 6 and 7.
Technical Drawing, Chapter 6.
Drafting Rules and Principles, pages 20-21.
Design Drafting, Chapter 7.
Basic Drafting Tools: (see unit LEG)

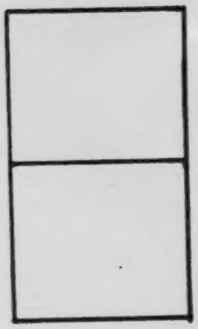
PROCEDURE:

1. Read Resource(s).
2. Number points on the given isometric sketch of each object.
3. Using dividers and projection techniques, locate each point on the given orthographic views: (Review page 152, Design Drafting).
   (Hint)
   Assign a number to each corner of the object. Use the same number for each point in both views. Note that the visible points nearest the observer are to be placed outside the object. (The invisible points,or) points under (or behind) other points, lines or planes are placed inside the object.
4. Project numbers from these views so that the projection lines intersect on the missing view, and complete the missing view by connecting these points.
5. Have instructor evaluate your work. Take the LAP test and proceed to the next LAP.

Principal Author(s): S. Vosen, J. Wheatley

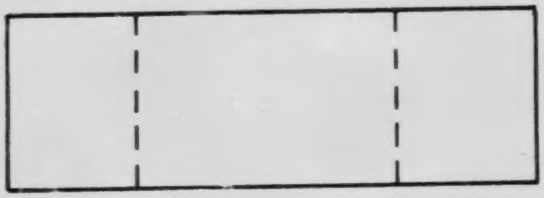


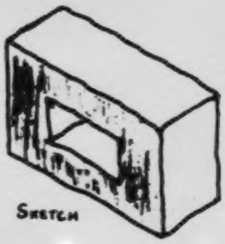




1

DRAW





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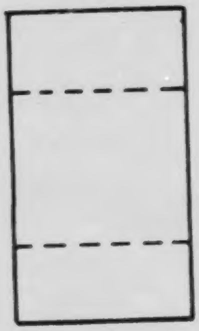

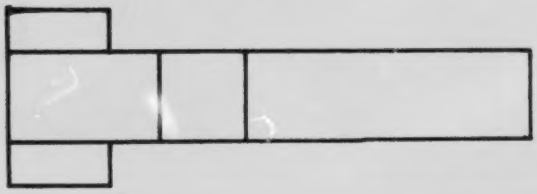

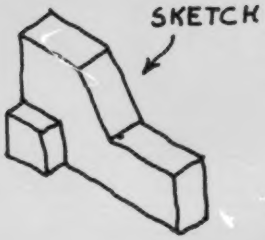

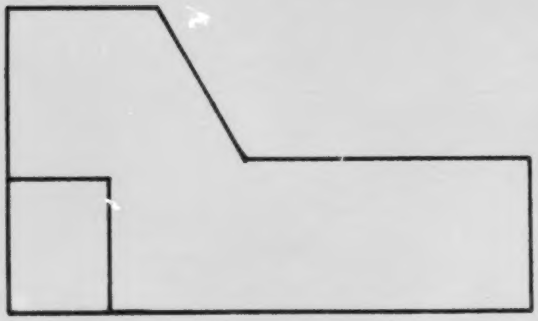

DRAW 3

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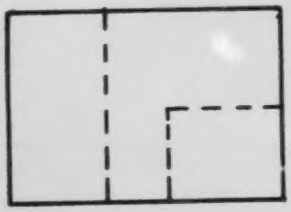

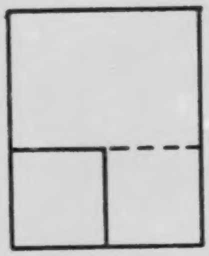

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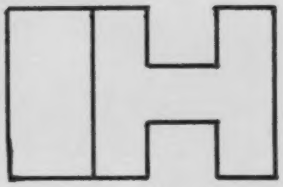
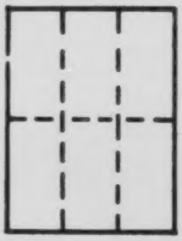
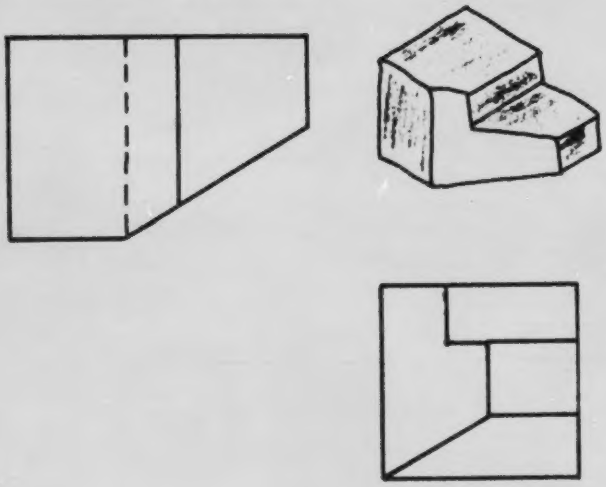




1



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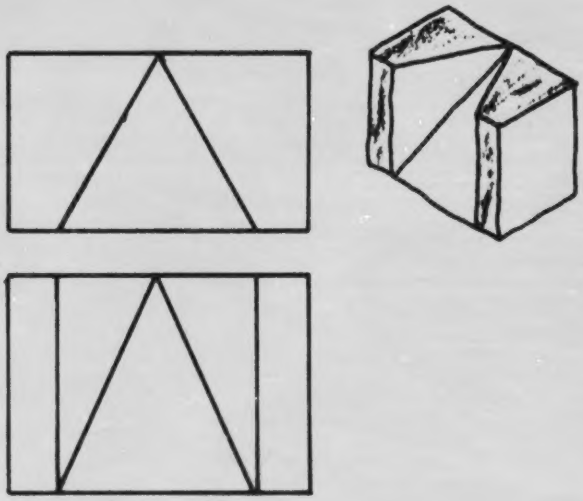

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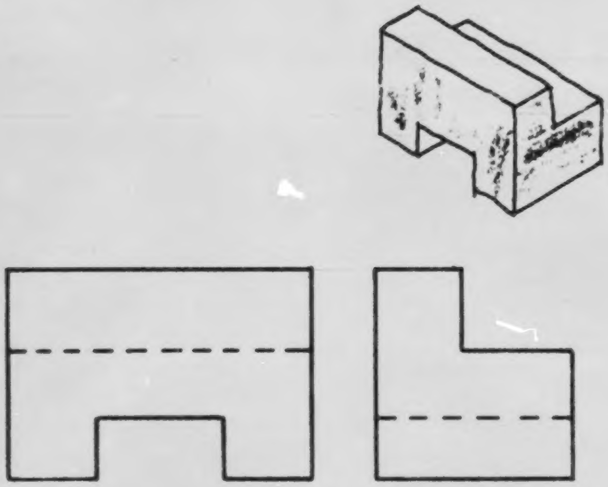

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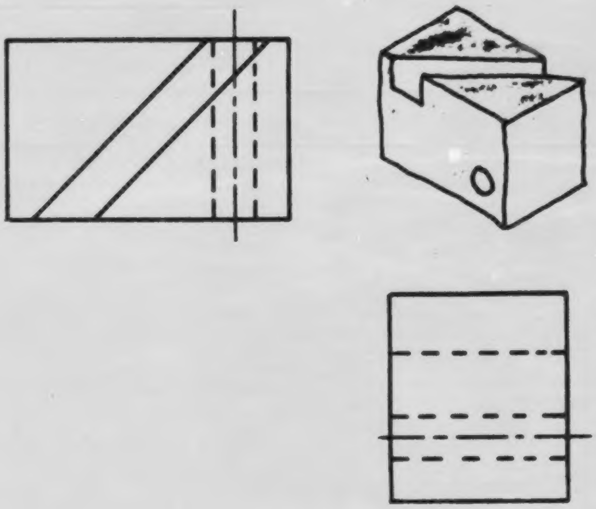

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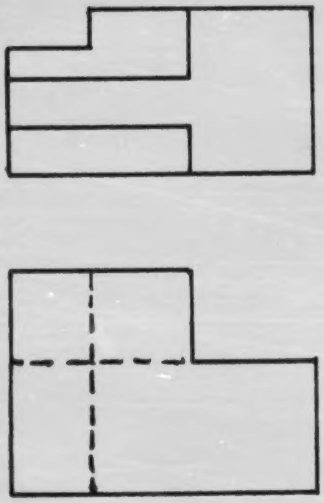

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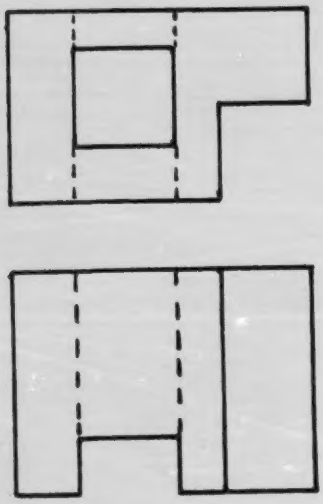

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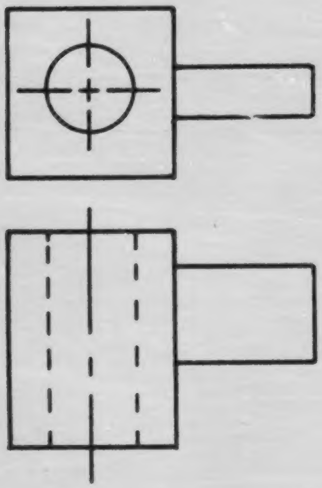

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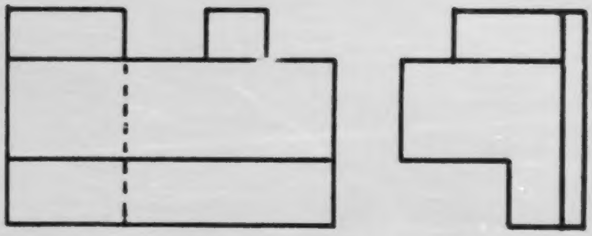


Student: ______________________ File Code: 79.01.04.03.A2-0

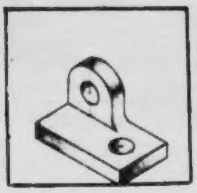
Date: ______________________ Date Published: 2/21/80

Family Education Program

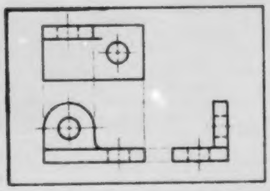
LAP TEST: PROJECTIONS USING A DIVIDERS

1. Which drawing below shows the correct position for orthographic projection?

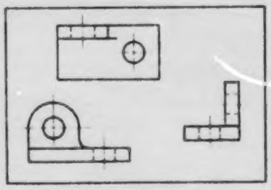
a.



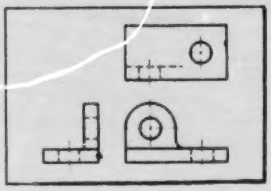
b.



c.



d.



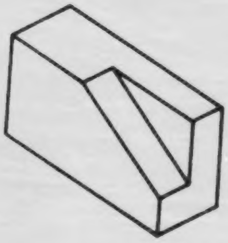
2. Which view of Figure 1 will show a five sided shape?

   a. top
   b. front
   c. right side
   d. left side

3. If you were numbering ALL the points on Figure 1, how many would there be?

   a. 11
   b. 20
   c. 16
   d. 12

FIGURE 1



4. What dimension(s) can the dividers transfer?

   a. height
   b. width
   c. depth
   d. all of these

5. If a surface is shown true size and shape in the top view, which view(s) will show the surface as a line?

   a. front
   b. right side
   c. both front and right side
   d. bottom

79.01.04.03.A2-0
2/21/80

LAP TEST ANSWER KEY

PROJECTIONS USING A DIVIDERS

1. B
2. B
3. D
4. D
5. C

File Code: 79.01.04.04.A2-0

Date Published: 1-17-79
Revised: 11-13-79

Family Education Program

Learning Activity Package

Student: ____________________

Date: ____________________

PERFORMANCE ACTIVITY: Sketching Missing Lines -- Visible and Hidden

OBJECTIVE:

Fill in missing lines to complete the views for given objects.

EVALUATION PROCEDURE:

Using a prepared key, the instructor will examine drawings to see if the correct isometric view has been drawn. All drawings must be correct.

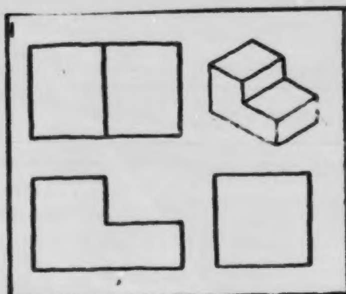
RESOURCES:

Design Drafting, Chapter 7
Basic Technical Drawing, Chapter 2, 6, and 7.
Basic Drafting Tools: (see unit LEG)
Drafting Furniture: (see unit LEG)

PROCEDURE:

1. Review the above resource(s).
2. Sketch in missing lines on the following objects.
3. Upon completion of this LAP. proceed to LAP .05.

VISIBLE LINES

1


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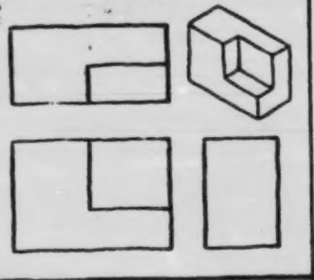

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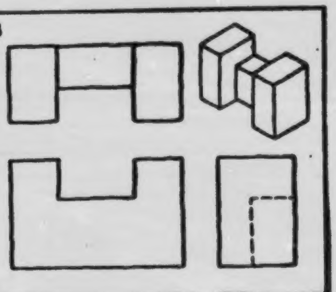

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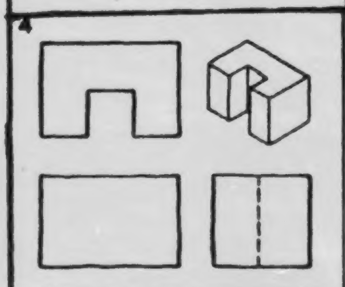

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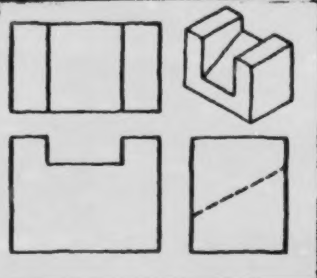

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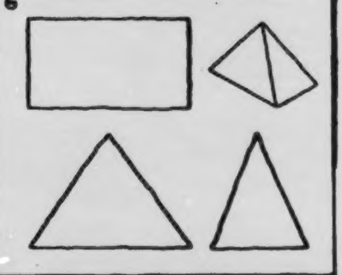
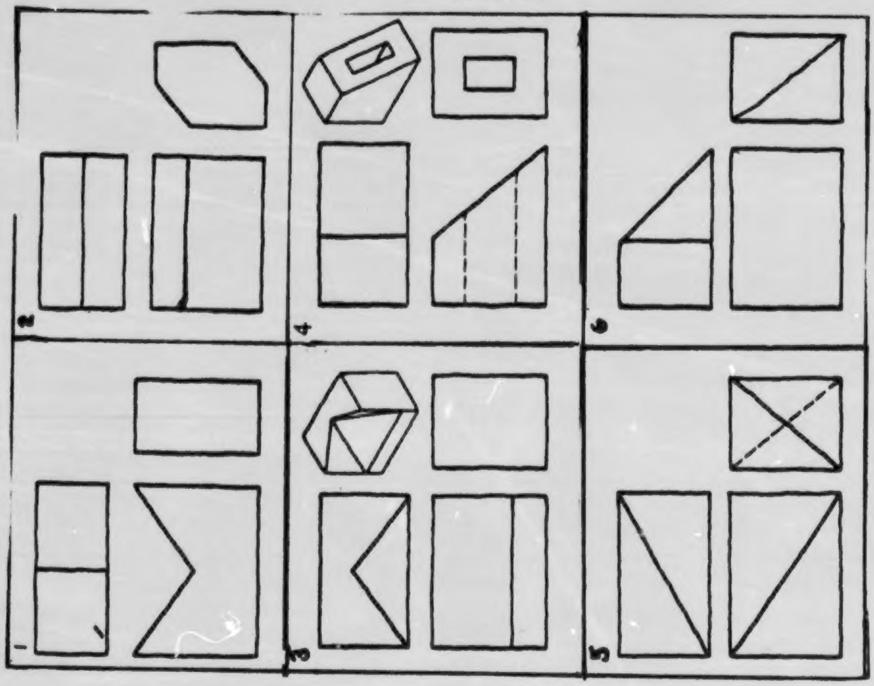


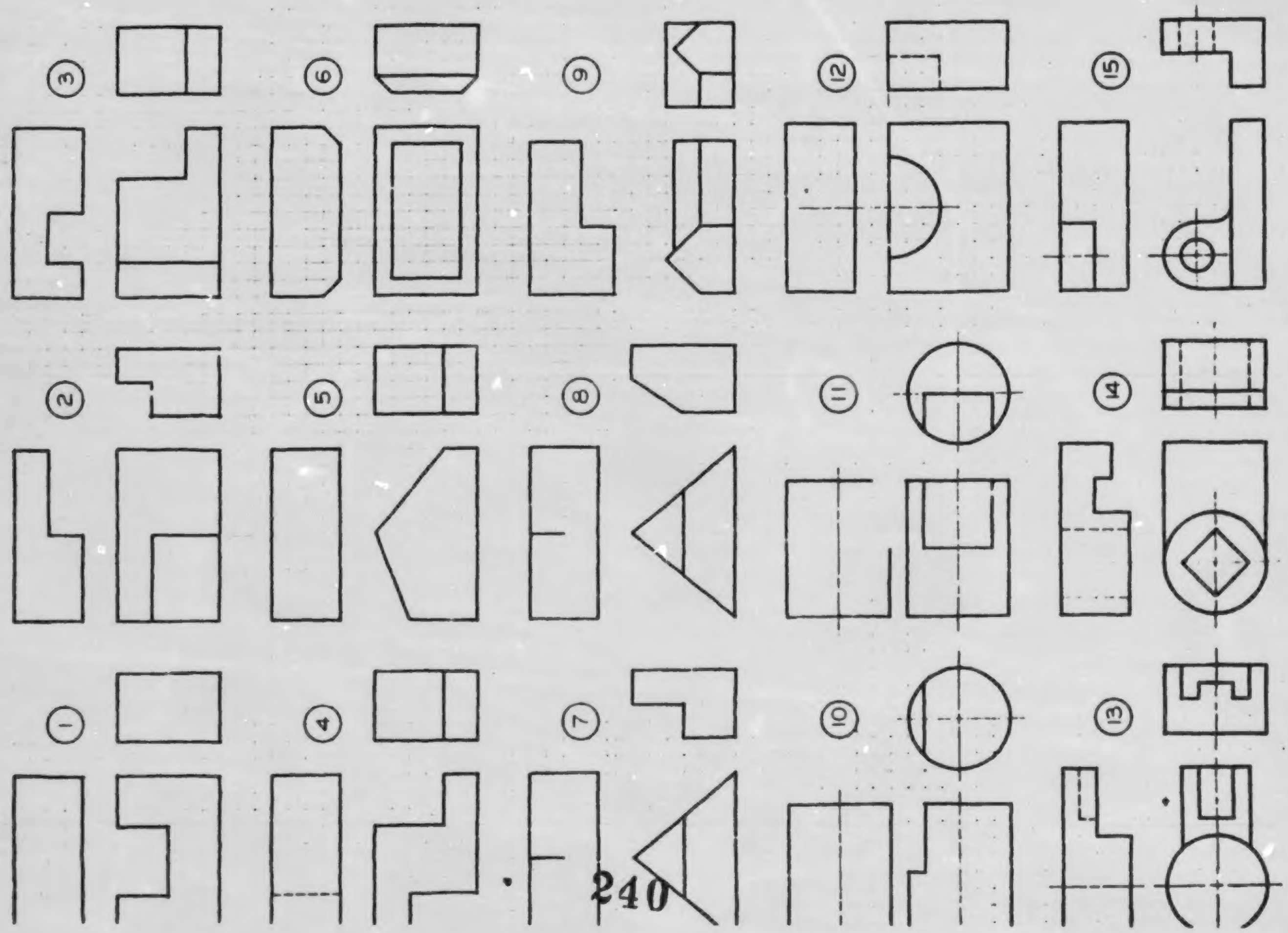
Principal Author(s):

S. Vosen, J. Wheatley

HIDDEN LINES



ASSORTED LINES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Student: ______________________ File Code: 79.01.04.04.A2-0

Date: ______________________ Date Published: 2/21/80

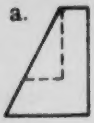
Family Education Program

LAP TEST: SKETCHING MISSING LINES

1. The three regular views in an orthographic sketch are:
   - a. width, height, depth.
   - b. top, front, leftside.
   - c. top, front, rightside.
   - d. elevator, plan, section.

2. The right side view of Figure 1 would look like:

a.



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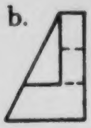

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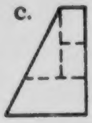
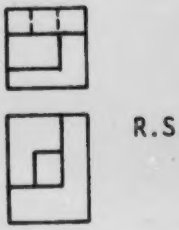


d. none of these.

FIGURE 1

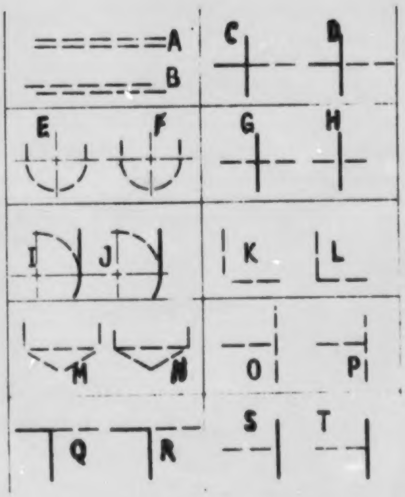


3. Which tool is used in sketching?
   - a. archtect scale
   - b. 45^{0} triangle
   - c. T-square
   - d. none of these

4. Which of the hidden line conventions shown in Figure 2 are correct?
   - a. D, L, R
   - b. A, F, L
   - c. T, O, J
   - d. B, I, N

5. If a hole were drilled in a top view, which convention in Figure 2 would be correct for the front view?
   - a. E
   - b. F
   - c. M
   - d. N

FIGURE 2



79.01.04.04.A2-0
2/21/80

LAP TEST ANSWER KEY

SKETCHING MISSING LINES

1. C
2. C
3. D
4. A
5. D

File Code: 79.01.04.05.A2-0

Date Published: 1-17-79
Revised: 11-13-79

Family Education Program

Learning Activity Package

Student: ____________

Date: ____________

PERFORMANCE ACTIVITY: Isometric Sketch and Drawing of Rectangular Objects

OBJECTIVE:

To sketch and draw isometric views of various rectangular objects.

EVALUATION PROCEDURE:

Using a prepared key, the instructor will examine drawings to see if the correct isometric view has been drawn. All drawings must be correct.

RESOURCES:

Basic Technical Drawing, Chapter 16 (paragraph 16.1 - 16.17)
Design Drafting, Chapter 9 (paragraph 9-1 through 9-18)
Basic Drafting Tools: (see unit LEG)
Drafting Furniture: (see unit LEG)

PROCEDURE:

1. Read the above resource(s).

3. Choose a real object without curves from the objects available at the desk. Using the attached sheet of isometric paper, make an isometric sketch of the object (refer to Chapter 16 - 16.16, Basic Drawing).

3. Make isometric sketches of the four given orthographic objects.

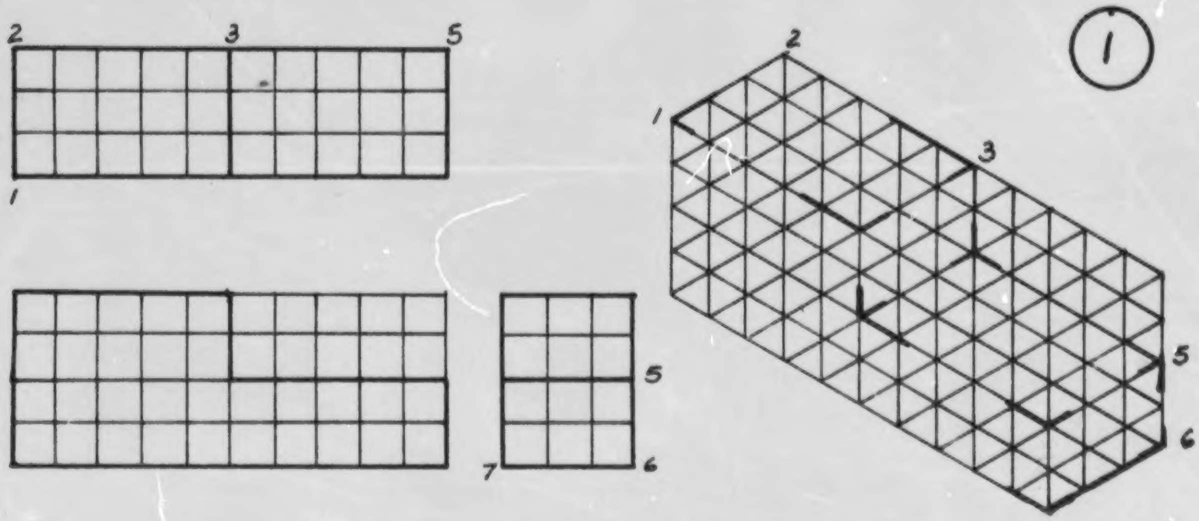
4. Divide a sheet of size "A" drawing paper into four equal rectangles on each side. Draw the following objects as isometric drawings: page 100, problems 1 through 8 in Basic Technical Drawing.

5. Have drawings evaluated by the instructor.

6. LAP test will be combined with and taken after completion of LAP .06.

Principal Author(s): S. Vosen, J. Wheatley

①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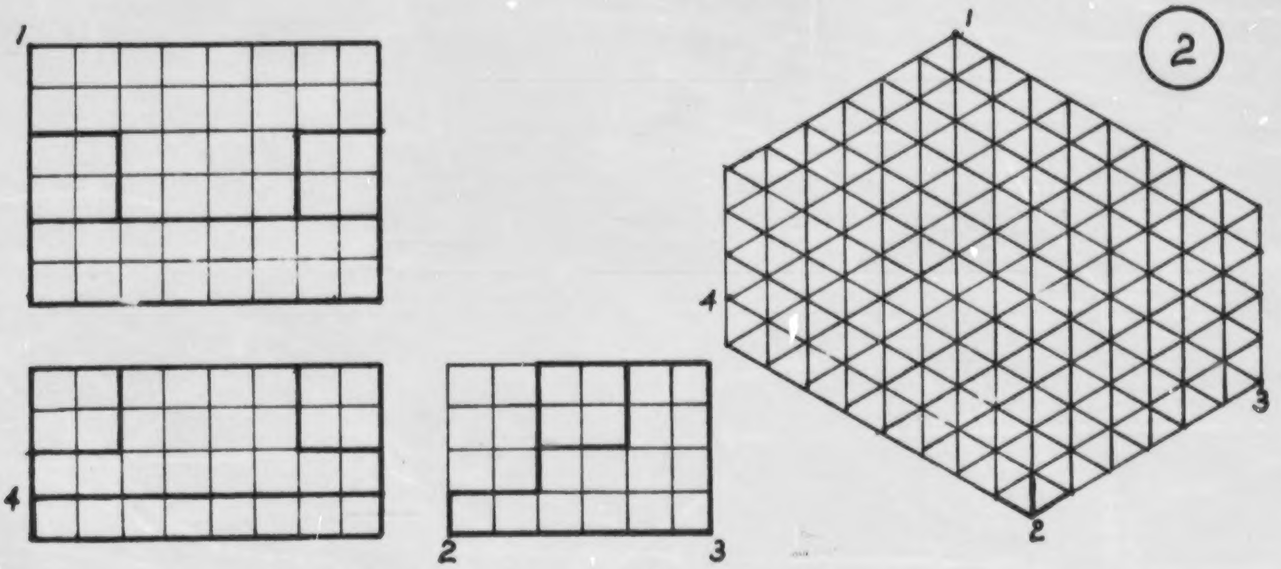

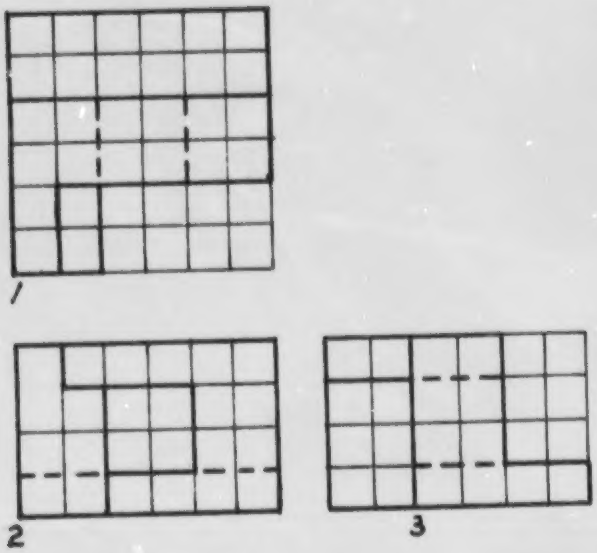

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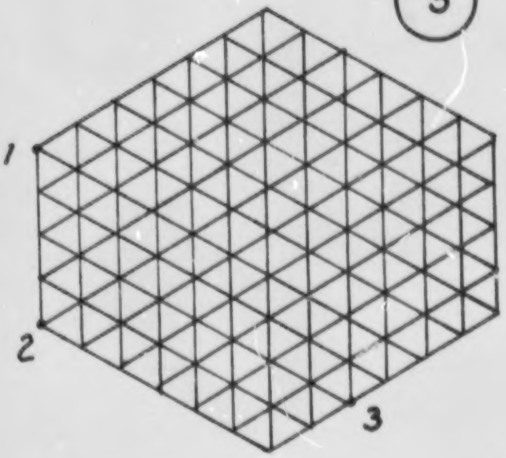
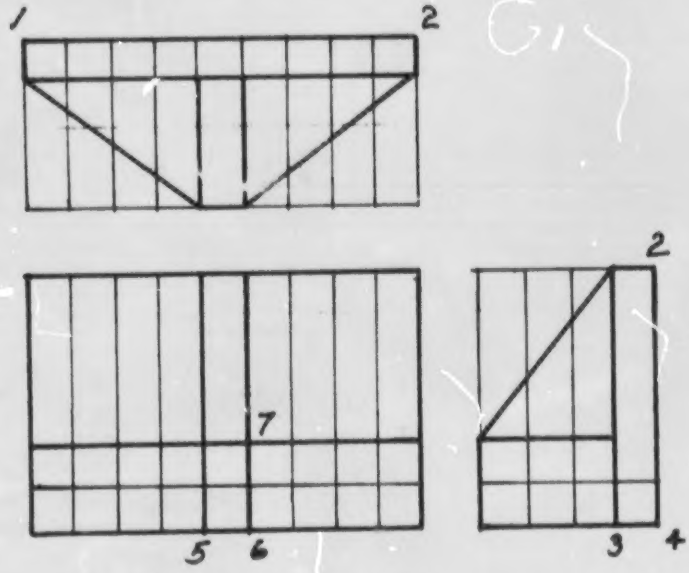
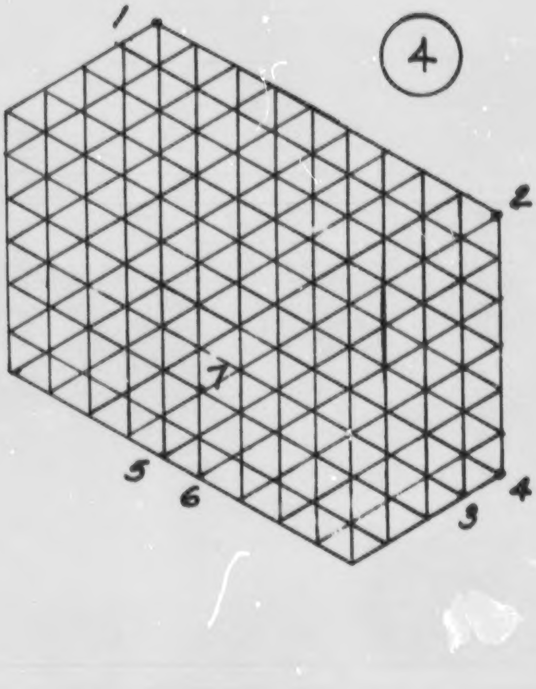


④





File Code: 79.01.04.06.A2-0

Date Published: 1-30-79
Revised: 11-14-79

Family Education Program

Learning Activity Package

Student: ____________________

Date: ____________________

PERFORMANCE ACTIVITY: Isometric Drawings of Cylindrical Objects and Objects with Major Holes and/or Curves

OBJECTIVE:

Given any object with major holes and/or curves, draw an isometric projection of the object.

EVALUATION PROCEDURE;

Using a prepared key, the instructor will examine drawings to see if the correct isometric view has been drawn. All drawings must be correct.

RESOURCES:

Design Drafting, Chapter 9
Basic Technical Drawing, Chapter 16
Basic Drafting Tools: (see unit LEG)
Drafting Furniture: (see unit LEG)

PROCEDURE:

1. Read the resource(s). Hint: Pay close attention to the use of isometric ellipse templates.

2. Using size "B" drawing paper, draw objects #9, 11, and 13 on page 100 and objects #11, 13, and 15 on page 101 of your Basic Technical Drawing. Also on a size "A" sheet of drawing paper draw object #1 on page 334 of your Basic Technical Drawing.

3. Take the combined LAP test for .05 and .06.

4. Go on to the performance test.

Principal Author(s): S. Vosen, J. Wheatley

Student: ______________________ **File Code:** 79.01.04.05/.06

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Family Education Program

LAP TEST: ISOMETRIC SKETCHES

1. Which views are shown on isometric sketches?

   a. top
   b. front
   c. right side
   d. all of these

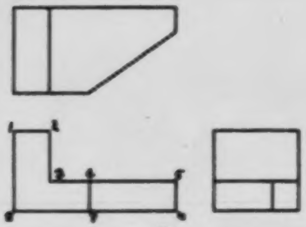
2. Which instrument is used to draw circles in isometric?

   a. compass
   b. French curve
   c. isometric template
   d. ellipse template

3. Which line(s) in Figure 1 will show true length in an isometric drawing?

   a. 1-2
   b. 3-5
   c. 7-6
   d. all of them.

FIGURE 1



4. The right, left, and vertical axes on an isometric sketch are how many degrees from each other?

   a. 30°
   b. 60°
   c. 90°
   d. 120°

5. Which dimension is placed on the vertical axis?

   a. width
   b. depth
   c. height
   d. all of these

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79.01.04.05/.06
2/25/80

LAP TEST ANSWER KEY

ISOMETRIC SKETCHES

1. D
2. C
3. A
4. D
5. C

SUPPLEMENTAL MATERIAL FOR DRAFTING

DRAWING REPRODUCTION

In general, there are three types of reproduction processes available to the draftsperson. They are: 1) mechanical, 2) photochemical, and 3) special. Each general process has several specific processes. Some of the more common under each heading is: 1) mimeograph, lithograph and typing, 2) blueprint, Van Dyke, Diazo, and photograph, 3) Thermofax, and Xerograph. The specific processes we are most interested in are Blueprinting and Diazo printing.

> Blueprinting: Blueprinting is the oldest process and was at one time the only reproduction method besides tracing and hand copying. However, it is being replaced. (For further information refer to Basic Technical Drawing, page 106, paragraph 7.4).
>
> Diazo Printing: Diazo printing (or whiteprints) is replacing the older methods. This is the process we use in the class. The Diazo print is made on sensitized paper by first exposing the paper under U-V and then developing it with ammonia fumes. (For further information refer to Basic Technical Drawing, page 107, paragraph 7.5).

In blueprinting, the background is a dark blue and the lines appear white. With Diazo, the background is white and the lines may be many colors. Some common colors are blue, black, brown, yellow, etc. With both processes, the original drawing must be made on a translucent material (i.e., vellum or mylar). The drawing itself may be done in either lead or ink.

Diazo is a two-step process. In the first step, the sensitized paper must be exposed. The paper has a coating, which when exposed to U-V light, is broken down and becomes nonreactive. The U-V light is passed through the translucent drawing exposing all but the portions covered by the lead or ink lines. There are four variables which affect the exposure. The type of Diazo paper, the weight of the line, the length of exposure, and the type of original.

Diazo paper comes in an assortment of speeds. From normal (speed 5) through super fast (speed 14). The faster paper has a more reactive sensitive coating and takes less U-V light to be exposed.

The weight of the line determines the amount of light which passes through the line. The heavier the line, the less light passed through and the more coating left on the paper. Naturally, ink will allow less light to pass through than lead.

The length of exposure is controlled by the speed setting on the expediter. There are two level settings and speed settings from A through Low. The slower the speed setting, the longer the length of exposure.

Originals may be drawn on several kinds of material. It may be on common bond paper, linen, vellum, or plastic film. The U-V light penetrates each material differently.

The second step in the Diazo process is to develop the exposed sensitized paper. The paper is passed through a machine which produces ammonia vapors. These vapors turn the reactive coating a different color then the exposed background. The length of time in the developer and the strength of the ammonia vapors determine the darkness of the developed lines. The machine used in this class is not adjustable so the number of times the paper is passed through it controls darkness. Other machines have speed controls.

Diazo printing is used for several different jobs. The most common is to reproduce one original so that several people can have copies. Also, copies are made so that the original will not be damaged during use. If only a few copies are needed, (1-20) they may be reproduced from the original. If more (20-200) are needed, a Sepia print is made from the original and the required copies are reproduced from the Sepia copy. Sometimes information recorded on common bond (white) paper is needed. Using extra fast paper, the Diazo process can make copies directly from the bond paper.

USE OF THE TWO-STEP DIAZO REPRODUCTION SYSTEM
(Rotolite Machine)

Follow the steps listed below:

1. Switch on the developer and then the ammonia pump. Let them run ten minutes before using the machine.

2. Get the correct size of Diazo paper from the cabinets. If necessary, but it to size on the paper cutter.

3. Switch on the expeditre and adjust the speed according to the attached chart.

4. Place the original face up on the green side of the Diazo paper. Holding both pieces with the face of the original toward you, feed it into the expediter.

5. Once the print is exposed, remove the original from the Diazo paper. Holding the Diazo paper face toward you, feed it into the developer.

6. Shut the expediter and the pump off. Leave the developer motor running for five minutes to clear the ammonia from the machine.

USE OF THE DIAZIT DART

Procedure:

1. Switch the machine on and wait until the U-V light stops flickering.

2. Set the speed control dial to the proper speed (see attached chart).

3. Place the original face up on the green side of the Diazo paper. Holding both pieces with the face of the original up toward you, feed them across the feed bar until the machine picks them up.

4. As both pieces come out of the machine, separate them and feed the Diazo paper into the developer.

5. When the print is developed, turn the machine off.

SUGGESTED SETTINGS FOR THE ROTOLITE BLUEPRINT MACHINE*

MACHINE WARM UP	PAPER SPEED**	ORIGINAL COPY	LINE WEIGHT	ACTINIC LIGHT EXPOSURE ROLLER SPEEDS A-O***
10 minutes	5 Sepia	Vellum	Lead	Low -- E
		Vellum	Ink	Low -- H
		Mylar	Lead	Low -- G
		Mylar	Ink	Low -- I
10 minutes	7	Vellum	Lead	High -- J
		Vellum	Ink	High -- Low
		Mylar	Lead	High -- H
		Mylar	Ink	High -- K
10 minutes	9 (Extra Fast)	Standard White	Lead	Low -- J
		Vellum	Lead	High -- I
		Vellum	Ink	High -- K
		Mylar	Lead	High -- G
		Mylar	Ink	High -- J
10 minutes	10	Standard White	Lead	Low -- J
		Vellum	Lead	High -- H
		Vellum	Ink	High -- J
		Mylar	Lead	High -- F
		Mylar	Ink	High -- I

*This machine uses a dry-ammonia vapor developing process.

**Paper speeds from 5 - 14 -- (slow, fast, extra fast, super fast) -- can be obtained.
(We use speeds 5, 7, 9, 10: 5 -- for corrections only.
7 -- slowest speed, more background print.
9 & 10 -- fastest speeds, cleaner background print.

***Roller speeds: A -- fastest
O -- slowest

Diazo Type and Speed**	Original Medium	Line Medium	Machine Speed***
#5 Sepia or Tuf-Tex	Vellum	Lead	4
	Vellum	Ink	3
	Mylar	Lead	4
	Mylar	Ink	3
#7 Diazo	Vellum	Lead	6-7
	Vellum	Ink	5
	Mylar	Lead	6-7
	Mylar	Ink	5
#9 Diazo	Bond Paper	Lead/Ink	4
	Vellum	Lead	7
	Vellum	Ink	6
	Mylar	Lead	7
	Mylar	Ink	6
#10 Diazo	Bond Paper	Lead/Ink	5
	Vellum	Lead	8
	Vellum	Ink	7
	Mylar	Lead	8
	Mylar	Ink	7

*WARNING: This machine uses 26° baume, full strength, aqueous ammonia as a developing agent. Aqueous ammonia and its vapors have been identified as toxic and could cause serious personal injury if handled or used incorrectly. Subparts I and Z of part 1910, Occupational Safety and Health Standards, chapter XVII of Title 29 of the Code of Federal Regulations, as amended, establishes procedures for the handling and storage of ammonia as well as exposure levels for ammonia vapors. It is each employer's responsibility to comply with these regulations. Please have your employees, as appropriate, become familiar with these regulations and be sure that this machine is used and operated in accordance with them.

**Paper speeds from 5-14 -- (slow, fast, extra fast, super fast) -- can be obtained.
We use speeds 5, 7, 9, 10:
5 -- for corrections only.
7 -- slowest speed, more background print.
9 & 10 -- fastest speed, cleaner background print.

NOTE: When combining paper and roller speeds, faster paper requires less time to expose; therefore, use a faster roller setting. Slower paper requires more time to expose; therefore, use a slower roller setting.

***Machine Speeds: 0 -- Slowest (more light exposure results in a lighter print with less background print).
21 -- Fastest (less light exposure, causes a darker print, but more background print may result).

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Mountain-Plains Education & Economic Development Program, Inc.
Glasgow AFB, Montana 59231

Learning Experience Guide

UNIT: MULTIVIEW PROJECTIONS: TECHNIQUES AND APPLICATIONS

RATIONALE:

In manufacturing, it is often necessary to have drawings of the object which clearly show surfaces in their true size and shape. The common method of doing this is called orthographic projection or multiview projection. Also, as each person in the manufacturing process needs a drawing of the object, methods were devised to reproduce those drawings. In this unit you will learn to provide a multiview drawing of an object and the copies needed.

PREREQUISITES:

Unit: 79.01.04 Shape Description

OBJECTIVES:

Draw an orthographic drawing of a given illustration using appropriate tools, procedures, techniques, and applications.

Identify terms, definitions and characteristics of orthographic drawings.

Identify terms and characteristics of various reproduction methods and use the Diazo process properly.

RESOURCES:

Printed Materials

Basic Technical Drawing. Spencer and Drydon, Macmillan Company, New York.
Engineering Drawing and Graphic Technology. French and Vierck, Eleventh Edition, McGraw-Hill Book Company, New York.
Mechanical Drawing. French and Svenson, Webster Division, McGraw-Hill Book Company, New York.
Technical Drawing. Sixth Edition, Gieseche, Mitchell, Spencer and Hill, Macmillan Company, New York.

Equipment

Basic Drafting Tools: As listed in the course LEG.

Principal Author(s): C. Wetterling, J. Wheatley

Resources: (continued)

Diazo Reproduction System
Drafting Furniture: stool, drafting
table, drafting (with T-square, parallel rule and/or drafting machine).

GENERAL INSTRUCTIONS:

This unit consists of four Learning Activity Packages (LAPs). Each LAP will provide specific information for completion of a learning activity.

The general procedure for this unit is as follows:

1. Read the first assigned Learning Activity Package (LAP).
2. Begin and complete the first assigned LAP.
3. Keep the drawing mounted on the board until it has been checked and approved by the instructor.
4. If there is a LAP test indicated on the LAP sheet, take the LAP test before going on to the next LAP.
5. Proceed to and complete the next assigned LAP in the unit.
6. Complete all required LAPs for the unit by following Steps 3 and 4.
7. Take the unit tests as described in the Unit LEG "Evaluation Procedures".
8. Proceed to the next assigned unit.

PERFORMANCE ACTIVITIES:

.01 Multiview Projection of a Bearing Cap
.02 Multiview Projection of a Guide Base
.03 Multiview Projection of a Guide
.04 Multiview Projection of a Wedge Base

EVALUATION PROCEDURE:

When post testing:

1. The student takes a multiple-choice post test and turns it in for correction.

2. The student takes a unit performance test. Successful unit completion is meeting the listed criteria for the performance test.

FOLLOW-THROUGH:

The skill of drawing multiview projection will be used again in future units and will be monitored when the opportunity arises.

The drawings in this unit must all have the title block and boarder properly inked. All title headings should be in Leroyed in ink and the rest freehanded in pencil. In addition, each drawing must have the three views (top, front and right side) properly positioned and correctly spaced. Use 12" x 18" drawing paper.

Begin the first assigned Learning Activity Package (LAP).

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Date: ______________________ Date Published: 6/20/74

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UNIT/LAP PRETEST: MULTIVIEW PROJECTION

1. Multiview means:

   a. one view.
   b. two views.
   c. two or more views.
   d. three views.

2. The top view is:

   a. over the front view.
   b. over the side view.
   c. below the front view.
   d. below the side view.

3. In orthographic projection, the projectors are:

   a. at a 45 degree angle to the plane of projection.
   b. parallel to the plane of projection.
   c. perpendicular to the plane of projection.
   d. at a 30 degree angle to the plane of projection.

4. The rear, left side, and front views are:

   a. aligned vertically and are the same height.
   b. aligned horizontally and are the same width.
   c. aligned horizontally and are the same height.
   d. aligned vertically and are the same width.

5. Depth dimensions in the top and side views:

   a. must correspond point-for-point.
   b. must correspond in the left side but not the right side.
   c. must correspond in the right side but not the left side.
   d. do not correspond.

6. A removed view is a complete or partial view that is:

   a. not in direct projection with any other view.
   b. left out of the regular projection.
   c. drawn on another sheet of paper.
   d. never drawn on a working drawing.

7. If a series of parallel planes is intersected by another plane, the resulting opposite angles of intersection will be:

   a. equal
   b. perpendicular.
   c. parallel.
   d. unequal.

8. A blind hole is one with a specified:

   a. arc length.
   b. radius.
   c. diameter.
   d. depth.

9. A rounded interior corner is called a:

   a. fillet.
   b. round.
   c. sharp corner.
   d. rough corner.

10. A rounded exterior corner is called a:

    a. round.
    b. fillet.
    c. sharp corner.
    d. rough corner.

UNIT/LAP PRETEST ANSWER KEY: MULTIVIEW PROJECTION

1. C
2. A
3. C
4. C
5. A
6. A
7. A
8. D
9. A
10. A

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Revised: 3-9-79

Learning Activity Package

Student: ____________________
Date: ____________________

PERFORMANCE ACTIVITY: Multiview Projection of a Bearing Cap

OBJECTIVE:

Draw a multiview projection of a bearing cap.

EVALUATION PROCEDURE:

Instructor will examine drawing against a prepared key for accuracy, line conventions, construction, and neatness. No more than three errors will be allowed on the drawing.

RESOURCES:

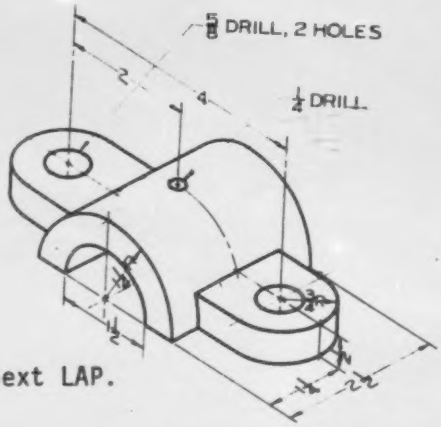
Basic Technical Drawing, Chapter 7 (Figure 7-67)
Basic Drafting Tools: (See Unit LEG)
Drafting Furniture: (See Unit LEG)

PROCEDURE:

1. Draw a multiview projection of the drawing, at the right, in full scale.

   NOTE: Refer to resource book if needed.

2. The drawing will be done in pencil on a 12 x 18 sheet of drawing paper. Ink the standard title block and boarder.
3. Have the drawing evaluated by the instructor.
4. The LAP test is combined with the LAP test on the next LAP.
5. Go on to the next LAP.



Bearing Cap.
Cast Iron

Principal Author(s): Q. Fogleman
Revised By: Sheila Vosen and Jere Wheatley

Student: ______________________ File Code: 79.01.05.01/02:C2-2

Date: ______________________ Date Published: 3-8-79

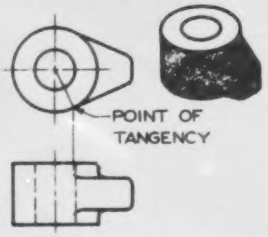
Family Education Program

LAP TEST: MULTIVIEW PROJECTION -- (combined test)

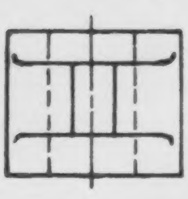
1. A depth dimension is found on which of the following views?

   a. top, front and R.S.
   b. L.S., front and R.S.
   c. R.S., top and L.S.
   d. front, top and back

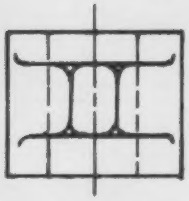
2. Given the following figure, which one of the R.S. views below is correct?



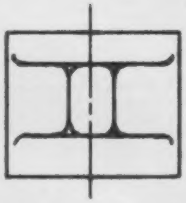
A



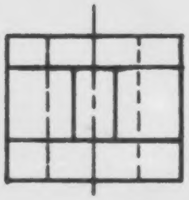
B



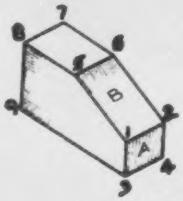
C



D



3. On the figure below, what points are shown of the R.S. view?



   a. 1, 2, 3, and 4
   b. 1, 2, 3, 4, 5, and 6
   c. 1, 3, 9, 8, and 5
   d. All of them.

4. The L.O.S. (Line of Sight) in multiview projection is __________ to the surface being viewed.

   a. perpendicular
   b. parallel
   c. at a 60^0 angle
   d. equal

5. Which of the below is not good pencil technique?

   a. dark construction lines
   b. dense, dark object lines
   c. sharp, clean corners
   d. correct line thickness and dash lengths

COMBINED LAP TEST - MULTIVIEW PROJECTION

1. B
2. B
3. D
4. A
5. A

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Learning Activity Package

Student: ____________

Date: ____________

PERFORMANCE ACTIVITY: Multiview Projection of a Guide Base

OBJECTIVE:

Draw a multiview projection of a guide base.

EVALUATION PROCEDURE:

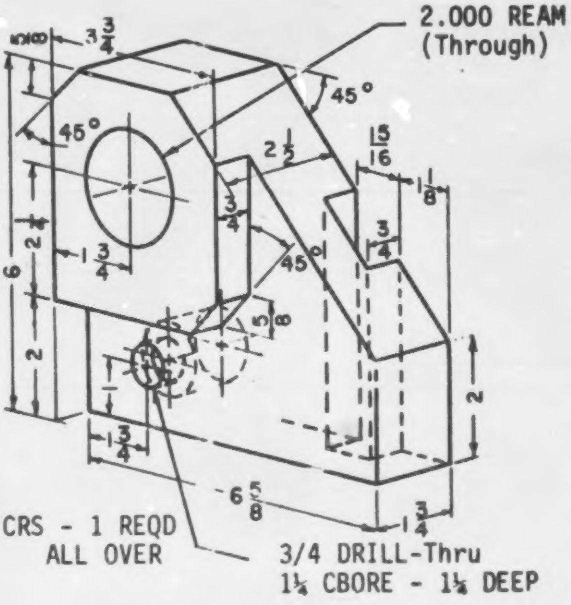
Instructor will examine drawing against a prepared key for accuracy, line conventions, construction, and neatness. No more than three errors will be allowed on the drawing.

RESOURCES:

Basic Technical Drawing, Chapter 7 (Figure 7-47).
Basic Drafting Tools: (See Unit LEG)
Drafting Furniture: (See Unit LEG)

PROCEDURE:

1. Read the above resource(s).
2. Draw a multiview projection of the drawing on this sheet.
3. The drawing will be done in pencil on a sheet of 12 x 18 drawing paper. Ink the standard title block and boarder.
4. Have the instructor evaluate the drawing.
5. Take the combined LAP Test.
6. Proceed to the next LAP.


3/8
3 3/4
2.000 REAM (Through)
45°
45°
2 1/2
15/16
1 1/8
3/4
3/4
2 1/4
6
1 3/4
45°
5/8
2
1
2
1 3/4
6 5/8
1 3/4
CRS - 1 REQD
ALL OVER
3/4 DRILL-Thru
1¼ CBORE - 1¼ DEEP

Guide Base. Draw ½ size

Principal Author(s): C. Wetterling, S. Vosen, J. Wheatley

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Learning Activity Package

Student: ____________________

Date: ____________________

PERFORMANCE ACTIVITY: Multiview Projection of a Guide

OBJECTIVE:

Draw a multiview projection of a guide and reproduce a Diazo copy.

EVALUATION PROCEDURE:

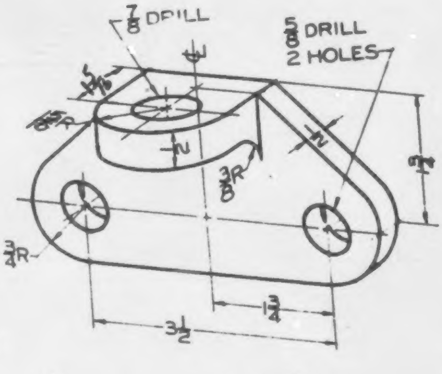
Instructor will examine the Diazo copy against a prepared key for accuracy, line convention, construction, neatness, and print clarity. No more than three errors will be allowed on the drawing.

RESOURCES:

Basic Technical Drawing, Chapter 7 (Fig. 7-65)
Supplemental material: Drawing reproduction
Basic Drafting Tools: (See Unit LEG)
Drafting Furniture: (See Unit LEG)

PROCEDURE:

1. Draw a multiview projection of the drawing indicated on this sheet. The drawing will be done in pencil on 12 x 18 first. NOTE: Refer to Chapter 7 in the resource book if needed.
2. Trace the drawing in ink on a sheet of 12 x 18 vellum. Use the following ink pens for correct line weight: Center lines -- #00; Hidden lines -- #0, and Object lines -- #1.
3. Use the Diazo machine and reproduce a copy to be evaluated by the instructor. (Refer to reproduction supplement).
4. The LAP test is combined with the next LAP test.
5. Proceed to next LAP.



Guide
H.R.S.

Principal Author(s): Q. Fogleman, S. Vosen, and J. Wheatley

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Revised: 3-7-79

Learning Activity Package

Student: ______________________

Date: ______________________

PERFORMANCE ACTIVITY: Multiview Projection of a Wedge Base

OBJECTIVE:

Draw a multiview projection of a wedge base and reproduce a Diazo copy.

EVALUATION PROCEDURE:

Instructor will examine the Diazo copy against a prepared key for accuracy, line convention, construction, neatness and print clarity. No more than three errors will be allowed on the drawing.

RESOURCES:

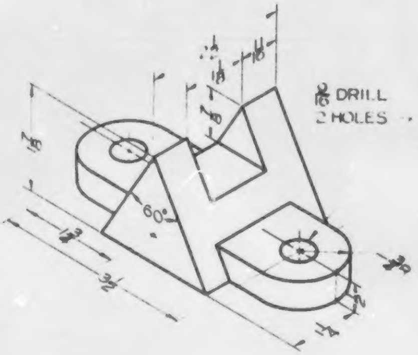
Basic Technical Drawing, Chapter 7 and 8 (Figure 7-62)
Supplemental material: Drawing Reproduction
Basic Drafting Tools: (See Unit LEG)
Drafting Furniture: (See Unit LEG)

PROCEDURE:

1. Draw a multiview projection of the drawing indicated on this sheet. The drawing will be done in pencil on a 12 x 18 sheet first.

   NOTE: Refer to the resource book if needed.

2. Obtain a sheet of vellum, overlay your drawing and make an ink copy including the title block and boarder. Use the line weights given in previous LAP.
3. Use the Diazo machine and reproduce a copy to be evaluated by the instructor.
4. Take the combined LAP Test.
5. Proceed to the Performance Test.



Wedge Base.*

CRS

Principal Author(s): C. Wetterling, S. Vosen and J. Wheatley

Student: ____________________ File Code: 79.01.05.03/04:C2-2

Date: ____________________ Date Published: 3-8-79

Family Education Program

LAP TEST: REPRODUCTION TECHNIQUES -- (combined test)

1. The reproduction process used in this class is:

   a. blueprint
   b. Thermofax
   c. Diazo
   d. Xerox

2. If a print has too much background, you must:

   a. speed up the machine
   b. slow down the machine
   c. use slower paper
   d. print darker

3. When inking a drawing for reproduction, what is the correct order of lines?

   a. horizontal, vertical, inclined, curved
   b. vertical, horizontal, inclined, curved
   c. inclined, horizontal, curved, vertical
   d. curved, horizontal, vertical, inclined

4. The originals drawn in these LAP's were inked on:

   a. Vellum
   b. Mylar
   c. Bond paper
   d. Drawing paper

5. Which paper takes the longest exposure time?

   a. speed 5 Sepia
   b. speed 7 Bluline
   c. speed 9 Blacline
   d. speed 10 Bluline

COMBINED LAP TEST - REPRODUCTION TECHNIQUES

1. C
2. B
3. D
4. A
5. A

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Student: ______________________ **File Code:** 79.01.05.00.A1-5

Date: ______________________ **Date Published:** 11/06/74
Date Revised: 8/01/78

Family Pay # ______________ Sex: M F (Circle One)

UNIT PERFORMANCE TEST: MULTIVIEW PROJECTION

OBJECTIVE 1:

Given an illustration of a machined object, the student will be able to draw an orthographic drawing of it with three views that are properly centered, neat, and accurate to the given dimensions.

OBJECTIVE 2:

The student will be able to properly ink the completed drawings.

OBJECTIVE 3:

Reproduce a Diazo copy of the drawing.

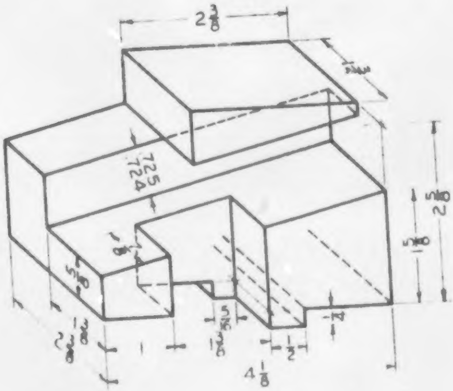
OBJECTIVE 4:

The student will be able to draw lines that are:

a. neat
b. properly drawn
c. weighted to appropriate contrasts.

TASK:

The student will make a Multiview Projection of the following object, and reproduce a Diazo copy.



Holder Base.*

ASSIGNMENT:

Draw the holder base found in Basic Technical Drawing, page 129. Use 12 x 18 drawing paper and trace the object in ink on vellum. Make a Diazo print.

CONDITIONS:

The drawing is to be completed in a typical drafting room setting, using the complete facilities.

The student will not be able to use the instructor(s) or other students as a resource.

RESOURCES: (See Unit LEG).

At least one of the following:

Technical Drawing, Giesecke/Mitchell/Spencer/Hill
Mechanical Drawing, French and Svenson
Enginerring Drawing and Graphic Technology, French and Vierck
Basic Technical Drawing, Spencer and Drydon

Blue/Black Line Printer.

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Student: ______________________ File Code: 79.01.05.00.A1-5

Date: ______________________ Date Published: 11/6/74
Revised: 8-01-78

Family Pay Number: __________ Sex: M F (Circle 1)

PERFORMANCE CHECKLIST:

OVERALL PERFORMANCE: Satisfactory _____ Unsatisfactory _____

	CRITERION	
	Met	Not Met
Objective 1:		
1. Complete object is drawn.		
Criterion: All lines specified in the assignment are drawn.		
2. Drawing consists of three views which are properly positioned		
Criterion: Object lines can be accurately projected from one view to another.		
Mechanical Drawing, pp. 87-91		
Objective 2:		
3. Complete drawing is inked correctly		
Criterion: (ASA Standards), Technical Drawing, p. 64. Boarder and title block lines (pen #2--LeRoy Template #175), object lines (pen #1), hidden lines (pen #0), Center lines (pen #00)		
Objective 3:		
4. Drawing is clean and neat		
Criterion: (ASA Standards), Technical Drawing, p. 12-22		

(Checklist continued)

	CRITERION	
	Met	Not Met
5. Drawing is centered correctly.		
Criterion: (ASA Standards), Technical Drawing, p. 167		
6. Total drawing is accurate to given dimensions.		
Criterion: Plus or minus 1/64"; plus or minus 1°		
Objective 4:		
7. Hidden lines are neat and properly drawn.		
Criterion: (ASA Standards), Technical Drawing, p. 145.		
8. Visible lines are neat and properly drawn.		
Criterion: (ASA Standards), Technical Drawing, p. 20		
9. Hidden lines are of appropriate contrast in relation to the other lines.		
Criterion: (ASA Standards), Technical Drawing, p. 20		
10. Visible lines are of appropriate contrast in relation to the other lines.		
Criterion: (ASA Standards), Technical Drawing, p. 20		
11. The drawing is completed in the specified time limit.		
Criterion: Not to exceed 5 hours.		
The student must meet criterion on 8 line items to obtain an overall score of satisfactory.		

Student: ______________________ File Code: 79.01.05.00.B2-2

Date: ______________________ Date Published: 6-20-74

Revised: 8-14-78

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UNIT POST TEST: MULTIVIEW PROJECTION

1. In American Standard projection there can be as many as:

   a. 3 principle views
   b. 6 principle views
   c. 1 principle view
   d. any number of principle views.

2. The top, front, and bottom views are:

   a. aligned horizontally and are the same height.
   b. aligned vertically and are the same height.
   c. aligned horizontally and are the same width.
   d. aligned vertically and are the same width.

3. If two lines are parallel in space, their projections are parallel in:

   a. the top view only.
   b. any view.
   c. the front view only.
   d. the end view only.

4. A line that is parallel to a plane of projection will be shown true size on:

   a. the plane of projection to which it makes a 60 degree angle.
   b. the plane of projection to which it is perpendicular.
   c. the plane of projection to which it makes a 45 degree angle.
   d. the plane of projection to which it is parallel.

5. Projection is the technical name for a:

   a. station point.
   b. line between the views.
   c. complete working drawing.
   d. view.

6. The process of drawing reproduction used in this course is called:

   a. blue printing.
   b. Diazo printing.
   c. lithograph printing
   d. Xerox printing.

7. The slower the original is passed through the exposure:

   a. the darker the lines will be.
   b. the more background print there will be.
   c. the less background print there will be.
   d. the clearer the lettering will be.

8. The most common materials for originals are:

   a. plastic film and transparent paper.
   b. classic drawing paper and blue line.
   c. clear paper and linen.
   d. bond paper and Mylar.

9. Depth dimensions are projected:

   a. from the top to the front view.
   b. from the right side view to the front view.
   c. from the right side view to the top view.
   d. from the top view to the back view.

10. To view a surface true size, your line of sight must be:

   a. perpendicular to the surface.
   b. parallel to the surface.
   c. from the front view.
   d. from the right side.

UNIT POST TEST ANSWER KEY: MULTIVIEW PROJECTION

1. B
2. D
3. B
4. D
5. D
6. B
7. C
8. A
9. C
10. A

Family Education Program

File Code: 79.01.06.00

Date Published: 11-17-78

Learning Experience Guide

UNIT: DIMENSIONING

RATIONALE:

Dimensions are just as important to working drawings as the views of the object. They clearly state the correct size to which the object must be made. It is therefore important that you learn how to correctly dimension drawings which tell the craftsman how to make the object. Different manufacturing processes require specific differences in dimensioning.

PREREQUISITES:

Unit: 79.01.05 -- Multiview Projection

OBJECTIVES:

The objective of this unit is to give the student the opportunity to demonstrate ability to correctly dimension orthographic drawings of four manufacturing processes.

Identify characteristics of correctly dimensioned orthographic drawings.

Draw a lead and vellum original which can be clearly reproduced by the Diazo Process.

RESOURCES:

Printed Materials

Basic Technical Drawing. Spencer and Drydon, MacMillan Company, New York.
Engineering Drawing and Graphic Technology. French and Vierck, Eleventh Edition, McGraw-Hill Book Company, New York.
Technical Drawing. Sixth Edition, Gieseche, Mitchell, Spencer and Hill, MacMillan Company, New York.
Handbook of Drafting Rules and Principles. First Edition, Nelson, McKnight and McKnight, Illinois.

Audio/Visuals

Size Description, Drafting Series, Doubleday Multimedia.

Equipment

Basic Drafting Tools: As listed in Course LEG.

Principal Author(s): S. Vosen, J. Wheatley, and C. Wetterling

RESOURCES: Equipment (continued)

Blue/Black line printer
Drafting Furniture: stool, drafting
table, drafting (with T-square, parallel rule and/or drafting machine)

Player, audio cassette
Projector, filmstrip

GENERAL INSTRUCTIONS:

This unit consists of four Learning Activity Packages (LAPs). Each LAP will provide specific information for completion of a learning activity.

The general procedure for this unit is as follows:

1. Read the first assigned Learning Activity Package (LAP).
2. Begin and complete the first assigned LAP. NOTE: Make drawing on tracing paper with pencil.
3. Make a blueprint copy of the drawing and have it evaluated by the instructor.
4. When the blueprint is satisfactory, proceed to and complete the next assigned LAP in the unit.
5. Complete all required LAPs for the unit by following Steps 3 and 4.
6. Take the unit tests as described in the Unit LEG "Evaluation Procedures".
7. Proceed to the next assigned unit.

PERFORMANCE ACTIVITIES:

.01 Dimensioning a Safety Key
.02 Dimensioning a Door Bearing
.03 Dimensioning a Centering Wedge
.04 Dimensioning a Holder Clip

EVALUATION PROCEDURE:

When post testing:

1. The student takes a multiple-choice post test and turns it in for correction.
2. The student takes a unit performance test. Successful unit completion is meeting the listed criteria for the performance test.

FOLLOW-THROUGH:

Dimensioning will be used and evaluated on all drawings completed for the rest of the course.

The drawings in this unit will all be done on 12" x 18" tracing paper (vellum). Ink the boarder and title blocks using proper format. Do all of the drawing and dimensioning in pencil. After completing each drawing, make a blueprint copy of it. Do not make a second copy unless instructed to do so.

Begin the first assigned Learning Activity Package (LAP).

Student: ______________________ File Code: 79.01.06.00. A2-2
(.01-.04)
Date: ______________________ Date Published: 6/20/74

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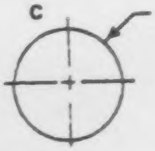
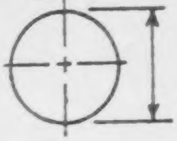
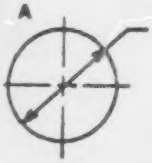
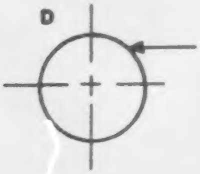
UNIT/LAP PRETEST: DIMENSIONING

1. The way to dimension a hole is:

C


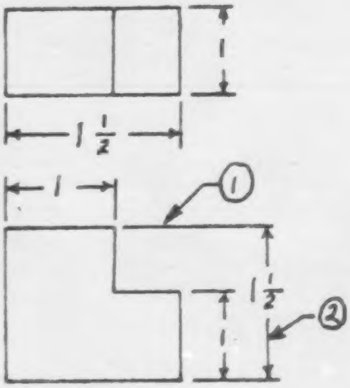
B


A


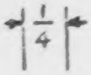
D


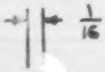
2. The system of writing dimensions shown below is the:

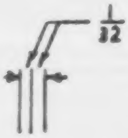
   a. only system used.
   b. the aligned system.
   c. bottom system.
   d. unidirectional system.



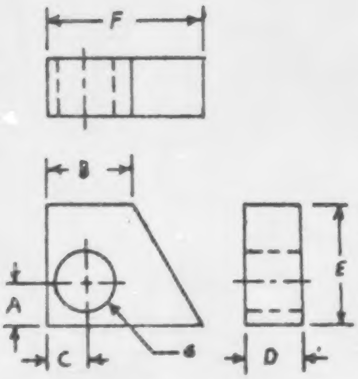
3. If space is limited, the correct way to indicate dimensions is:

a.


b.


c.


d. All are correct.



4. The location dimensions shown above are:

   a. A, C, and B.
   b. A and C.
   c. B and F.
   d. all dimensions are location dimensions.

5. The size dimensions shown above are:

   a. C, D, E, and F.
   b. D, E, and F.
   c. B, D, E, F, and G.
   d. all dimensions are size dimensions.

6. Drawings should be made to scale, and the scale should be indicated:

   a. on the object.
   b. in the title block.
   c. outside the border line.
   d. only when smaller than full scale.

7. Dimensions are given in the form of:

   a. linear distances, angles, or notes.
   b. fractions only.
   c. decimals only.
   d. arrowheads.

8. A fine, dark, solid line terminated by arrowheads that indicates direction and extent is:

   a. a dimension line.
   b. an extension line,
   c. a leader.
   d. a center line.

9. A dimension line coincides with or forms a continuation of a line on a drawing:

   a. when it matches a hidden line.
   b. whenever it is unavoidable .
   c. never.
   d. when it matches a center line.

10. A thin, solid line leading from a note or dimension and terminated by an arrowhead or dot touching the part to which attention is directed is:

    a. a center line.
    b. a leader.
    c. a dimension line.
    d.. an extension line.

79.01.06.00.A2-2
(.01-.04)

UNIT/LAP PRETEST ANSWER KEY: DIMENSIONING

1. C
2. D
3. D
4. B
5. C
6. B
7. A
8. A
9. C
10. B

File Code: 79.01.06.01

Date Published: 11-17-78

Family Education Program

Learning Activity Package

Student: ____________________

Date: ____________________

PERFORMANCE ACTIVITY: Dimensioning a Safety Key

OBJECTIVE:

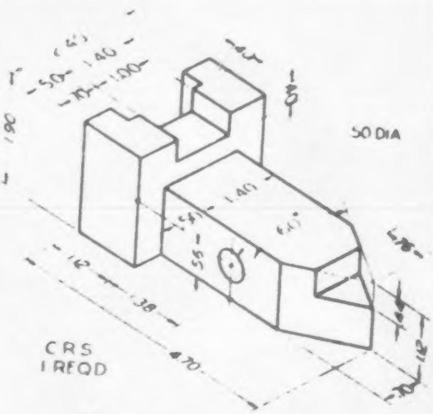
Draw and dimension an orthographic projection of an object machined from stock.

EVALUATION PROCEDURE:

Instructor will examine Diazo Prints for neatness, accuracy, clarity, line work and proper dimensioning.

RESOURCES:

Drafting Rules and Principles -- Chapter 3
Basic Technical Drawing -- Chapters 9 and 10.
Technical Drawing -- Chapters 10 and 11.
Engineering Drawing and Graphic Technology -- Chapters 11 and 12.
Basic Drafting Tools: (See Unit LEG)
Drafting Furniture: (See Unit LEG)
Blue/Black Line Printer
Filmstrip Projector
Audio Cassette Player
Size Description -- Drafting Series.



Safety Key

PROCEDURE:

1. Read the above resource(s).
2. View filmstrip on Size Description.
3. Draw and dimension an orthographic projection of the object shown on a 12" x 18" sheet of drawing paper.
4. Trace the object on vellum using lead and an inked border.
5. Have the instructor evaluate a blueprint copy of the completed drawing.
6. Take the LAP test for this LAP and proceed to LAP 02.

Principal Author(s): S. Vosen, J. Wheatley, C. Wetterling

Student: ______________________ **File Code:** 79.01.06.01

Date: ______________________ **Date Published:** 11-29-78

Family Education Program

LAP TEST: DIMENSIONING MACHINED OBJECTS

1. Dimensions are classified into two groups. They are:

   a. horizontal and vertical.
   b. necessary and unnecessary.
   c. size and location.
   d. inside and outside.

2. The standard height of letters and whole numbers used in dimensioning is:

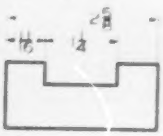
   a. 1/32
   b. 1/16
   c. 1/8
   d. 1/4

3. What is the ratio of arrowhead width to length?

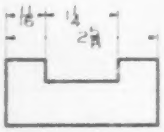
   a. 2:1
   b. 1:3
   c. 2:3
   d. as you choose.

4. Which object shown below has correct dimension placement?

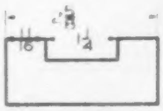
a.



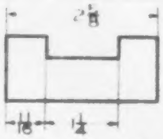
b.



c.



d.



5. There are two systems of reading direction used in dimensioning. They are:

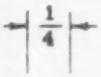
   a. vertical and horizontal.
   b. bottom and top.
   c. round and square.
   d. unidirectional and aligned.

6. An object which has square corners, a smooth finish all over, and no fillets or rounds has been:

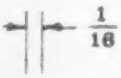
   a. cast.
   b. forged.
   c. welded.
   d. machined.

7. If space is limited, the correct way to indicate dimensions is:

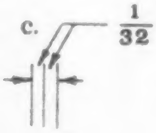
a.



b.



c.



d. All are correct.

8. Which of the following dimensions would be given as a radius?

   a. fillet.
   b. drill.
   c. hole.
   d. ream.

9. The first dimension line should be _____ inch from the object and ____ inch from the next dimension line.

   a. 1/4; 1/4
   b. 3/8; 1/4
   c. 3/8; 3/8
   d. 1/2; 1/2

10. Which rule listed below has priority over the others?

   a. dimension lines must not cross.
   b. dimensions must be between views.
   c. dimensions must be on a profile view.
   d. all are equally important.

LAP TEST ANSWER KEY: DIMENSIONING MACHINED OBJECTS

1. C
2. C
3. B
4. A
5. D
6. D
7. D
8. A
9. B
10. A

Family Education Program

File Code: 79.01.06.02

Date Published: 11-21-78

Learning Activity Package

Student: ____________________

Date: ____________________

PERFORMANCE ACTIVITY: Dimensioning a Door Bearing

OBJECTIVE:

Draw and dimension an orthographic projection of an object machined from stock and assembled by welding.

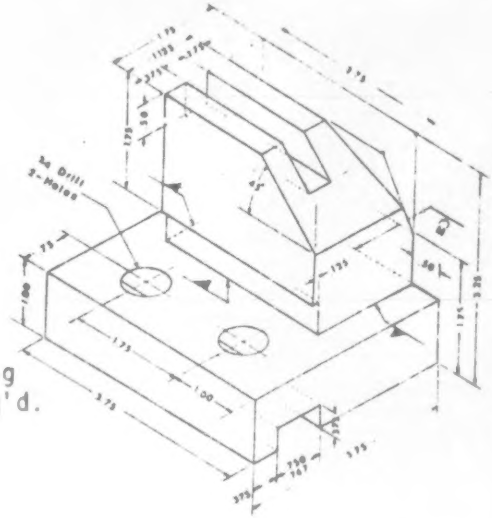
EVALUATION PROCEDURE:

Instructor will examine the Diazo prints for neatness, accuracy, clarity, line work and proper dimensioning.

RESOURCES:

Drafting Rules and Principles -- Chapter 3.
Basic Technical Drawing -- Chapters 9 and 10, and paragraph 15.16 of Chapter 15.
Technical Drawing -- Chapters 10, 11, and 25.
Engineering Drawing: Graphic Technology -- Chapters 11, 12, and 16.

Basic Drafting Tools: (See Unit LEG)
Drafting Furniture: (See Unit LEG)
Blue/Black Line Printer



Door Bearing
CRS - 1 req'd.

PROCEDURE:

1. Draw and dimension an orthographic projection of the object given on a 12" x 18" sheet of drawing paper. NOTE: Review resource(s) if necessary.

2. Trace the object on vellum using lead and an inked border.

3. Have the instructor evaluate a blueprint copy of the completed drawing.

4. Take the LAP test and proceed to next LAP.

Principal Author(s): S. Vosen, J. Wheatley, O. Fogleman

Student: ____________________ File Code: 79.01.06.02

Date: ____________________ Date Published: 11-29-78

Family Education Program

LAP TEST: DIMENSIONING WELDED/MACHINED OBJECTS

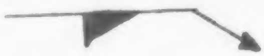
1. Drawing scale is usually shown:

   a. at the top left-hand corner.
   b. on the object.
   c. in the title block.
   d. in feet.

2. Center lines may be used as a(n):

   a. extension line.
   b. dimension line.
   c. leader.
   d. arrowhead.

3. The following symbol is a specialized weld symbol. What does it mean?

   a. triangle weld.
   b. fillet weld-arrow side.
   c. 30°/60° round weld.
   d. weld all over.

4. A note on a drawing is:

   a. used to provide detailed information.
   b. shown in all views.
   c. lettered in 1/4 letters.
   d. rarely used.

5. Every draftsperson uses weld symbols:

   a. that he has decided on.
   b. which are different from those which other draftspersons use.
   c. on every object.
   d. which conform to AWS Standards.

LAP TEST ANSWER KEY: DIMENSIONING WELDED/MACHINED OBJECTS

1.	C
2.	A
3.	B
4.	A
5.	D

File Code: 79.01.06.03

Date Published: 11-17-78

Family Education Program

Learning Activity Package

Student: ____________________

Date: ____________________

PERFORMANCE ACTIVITY: Dimensioning a Centering Wedge

OBJECTIVE:

Draw and dimension an orthographic projection of a cast object with machined areas.

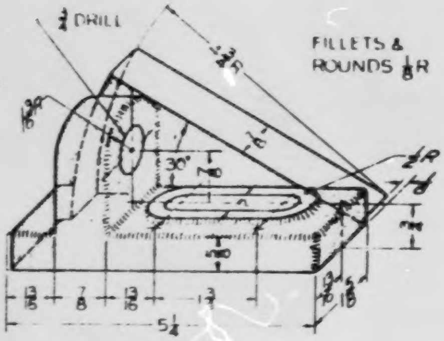
EVALUATION PROCEDURE:

Instructor will examine the Diazo prints for neatness, accuracy, clarity, line work and proper dimensioning.

RESOURCES:

Drafting Rules and Principles -- Chapter 3
Basic Technical Drawing -- Chapters 9 and 10.
Technical Drawing -- Chapters 10 and 11.
Engineering Drawing: Graphic Technology -- Chapters 11 and 12.

Basic Drafting Tools: (See Unit LEG)
Drafting Furniture: (See Unit LEG)
Blue/Black Line Printer



Centering Wedge

PROCEDURE:

1. Draw and dimension an orthographic projection of the given object on a 12" x 18" sheet of white drawing paper.

   NOTE: Refer to the reference books or filmstrip if necessary to complete drawing.

2. Trace the object, in lead, on vellum with an inked border.
3. Have the instructor evaluate a blueprint copy of the completed drawing.
4. Take the LAP test and proceed to the next LAP.

Principal Author(s): S. Vosen, J. Wheatley, Q. Fogleman

Student: ______________________ File Code: 79.01.06.03

Data: ______________________ Date Published: 11-29-78

Family Education Program

LAP TEST: DIMENSIONING CAST OBJECTS

1. A cast object can be identified by:

   a. the sharp corners and smooth finish.
   b. the thinness of the sheet material.
   c. the fillets, rounds, and rough finish.
   d. the machine finish marks.

2. A line which runs from a note, to the object, ending in an arrowhead is a(n):

   a. leader.
   b. extension line.
   c. dimension line.
   d. note line.

3. The material the object is cast from will be shown either in the title box or:

   a. the parts list.
   b. the border.
   c. on the object.
   d. in a note.

4. The size of fillets and rounds is usually given:

   a. on the object.
   b. in a note.
   c. in the title block.
   d. in thousandths of an inch.

5. Most dimensions on a cast object are either overall dimensions or are taken from:

   a. rough edges.
   b. machined surfaces.
   c. the rounds and fillets.
   d. notes.

LAP TEST ANSWER KEY: DIMENSIONING CAST OBJECTS

1. C
2. A
3. D
4. B
5. B

Family Education Program

File Code: 79.01.06.04

Date Published: 11-20-78

Learning Activity Package

Student: ______________

Date: ______________

PERFORMANCE ACTIVITY: Dimensioning a Holder Clip

OBJECTIVE:

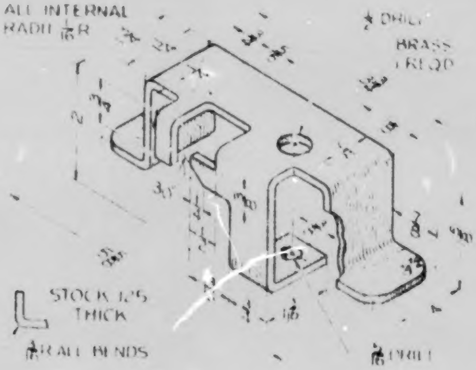
Draw and dimension an orthographic projection of an object manufactured from sheet brass.

EVALUATION PROCEDURE:

Instructor will examine the Diazo prints for neatness, accuracy, clarity, line work and proper dimensioning.

RESOURCES:

Drafting Rules and Principles -- Chapter 3
Basic Technical Drawing -- Chapters 9 and 10
Technical Drawing -- Chapters 10 and 11
Engineering Drawing and Graphic Technology -- Chapters 11 and 12
Basic Drafting Tools: (See Unit LEG)
Drafting Furniture: (See Unit LEG)
Blue/Black Line Printer



Holder Clip

PROCEDURES:

1. Draw and dimension an orthographic projection of the given object on a 12" x 18" sheet of drawing paper. NOTE: Refer to the reference books and/or filmstrip if necessary to complete drawing.
2. Trace the object, in lead, on a sheet of vellum with an inked border.
3. Have the instructor evaluate a blueprint copy of the completed drawing.
4. Take the LAP test and proceed to the Performance Test.

Principal Author(s): S. Vosen, J. Wheatley, C. Wetterling

Family Training Center, Inc.

Student: ____________________ File Code: 79.01.06.04

Date: ____________________ Date Published: 11-29-78

Family Education Program

LAP TEST: DIMENSIONING FORMED SHEET STOCK

1. When dimensioning objects formed from sheet stock, the thickness dimension is usually given:

   a. in the front view.
   b. in the right side view.
   c. as a note.
   d. in the title block.

2. The center line of a sheet metal bend is called the:

   a. bend allowance.
   b. neutral axis.
   c. inside mold line (IML)
   d. outside mold line (OML)

3. Dimensions should be placed in the view that shows the ____________ of the object.

   a. contour.
   b. edge.
   c. top.
   d. front.

4. What does the abbreviation NTS stand for?

   a. National Technical Society.
   b. Not To Scale.
   c. Not Too Symetrical.
   d. No True Shape.

5. Center lines may be extended and used as:

   a. object lines.
   b. dimension lines.
   c. extension lines.
   d. leaders

LAP TEST ANSWER KEY: DIMENSIONING FORMED SHEET STOCK

1. C
2. B
3. A
4. B
5. C

Student: ______________________ File Code: 79.01.06.00

Date: ______________________ Date Published: 11-20-78

Mountain-Plains Education & Economic Development Program, Inc.
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UNIT PERFORMANCE TEST: DIMENSIONING

OBJECTIVE 1:

Given an illustration of a machined object, the student will be able to draw an orthographic drawing of it.

OBJECTIVE 2:

The student will be able to properly dimension the completed drawing.

OBJECTIVE 3:

The student will be able to draw three views that are properly centered, neat and accurate to the given dimensions.

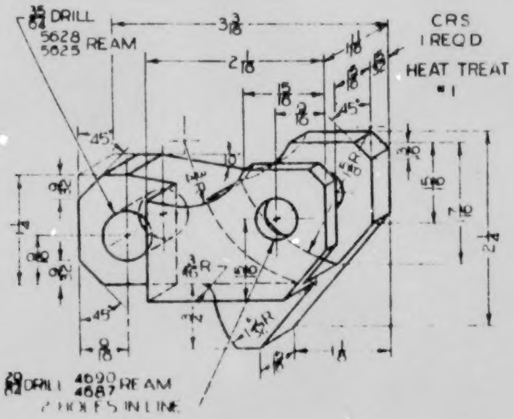
OBJECTIVE 4:

The student will be able to draw lines that reproduce on Diazo printing:

a) Neatly
b) Properly drawn
c) Weighted to appropriate contrasts.
d) With good clarity

TASK:

The student will make an orthographic drawing of a machined object. The finished drawing must be completely dimensioned.


35/64 DRILL
5628
5625 REAM
3 3/16
2 1/16
11/16
15/16
9/16
45°
45°
45°
3/16 R
15/32 R
9/16
29/64 DRILL 4690
4687 REAM
2 HOLES IN LINE
CRS
1 REQD
HEAT TREAT
#1

Roller Lever

ASSIGNMENT:

Draw and dimension the "Roller Lever" found on previous page. Use 12" x 18" drawing paper and reproduce a Diazo print.

CONDITIONS:

The drawing is to be completed in a typical drafting room setting, using the complete facilities.

The student will not be able to use the instructor(s) or other students as a resource.

RESOURCES:

As described in the Unit LEG.

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Student: ____________________ File Code: 79.01.06.00

Date: ____________________ Date Published: 11-20-78

Family Pay Number: __________ Sex: Male Female

PERFORMANCE CHECKLIST:

OVERALL PERFORMANCE: Satisfactory _____ Unsatisfactory _____

	CRITERION	
	Met	Not Met
Objective 1:		
1. Entire object is drawn		
Criterion: All lines specified in the assignment are drawn.		
Objective 2:		
2. Drawing is dimensioned using correct dimension techniques.		
Criterion: (ASA Standards). Drafting Rules and Regulations,		
Chapter 3.		
Objective 3:		
3. Drawing is clean and neat.		
Criterion: (ASA Standards), Technical Drawing, pp. 12 & 22.		
4. Drawing is centered.		
Criterion: (ASA Standards), Technical Drawing, page 167.		
5. Total drawing is accurate to given dimensions.		
Criterion: Plus or minus 1/64"; plus or minus 1 degree.		

(Checklist continued)

	CRITERION	
	Met	Not Met
Objective 4:		
6. Hidden lines are neat and properly drawn.		
Criterion: (ASA Standards), Technical Drawing, page 145.		
7. Visible lines are neat and properly drawn.		
Criterion: (ASA Standards), Technical Drawing, page 20.		
8. Center lines are neat and properly drawn.		
Criterion: (ASA Standards), Technical Drawing, page 20.		
9. Hidden lines are of appropriate contrast in relation to the other lines and reproduce clearly on Diazo print.		
Criterion: (ASA Standards), Technical Drawing, page 20.		
10. Visible lines are of appropriate contrast in relation to the other lines and reproduce clearly on Diazo print.		
Criterion: (ASA Standards), Technical Drawing, page 20.		
11. Center lines are of appropriate contrast in relation to the other lines and reproduce clearly on Diazo print.		
Criterion: (ASA Standards), Technical Drawing, page 20.		
12. The drawing is completed in the specified length of time.		
Criterion: Not to exceed 9 hours.		
The student must meet criterion on 10 line items to obtain an overall score of satisfactory.		

Student: ______________________ File Code: 79.01.06.00. B2-2 (.01-.04)

Date: ______________________ Date Published: 6/20/74

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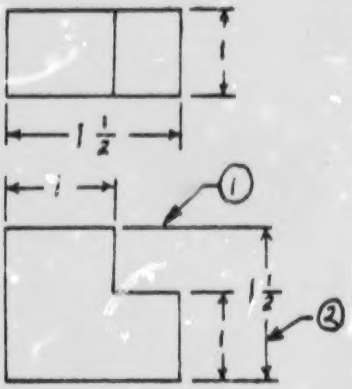
UNIT/LAP POST TEST: DIMENSIONING

1. Line 1 at right is:

   a. an extension line.
   b. a dimension line.
   c. a continuation line.
   d. an object line.



2. The system of writing dimensions shown at the right is the:

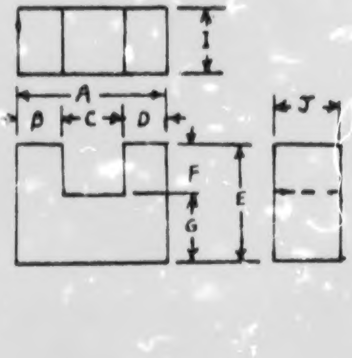
   a. only system used.
   b. the aligned system.
   c. bottom system.
   d. unidirectional system.

3. Line 2 at right is:

   a. a dimension line.
   b. an extension.
   c. a continuation line.
   d. an object line.

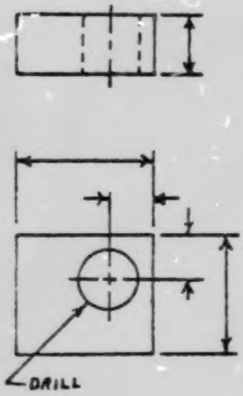
4. The dimensions necessary to completely describe the size of the size of the object below are:

   a. BCDFG and A.
   b. all the dimensions are necessary.
   c. ABDEG and F.
   d. ABCEF and J.

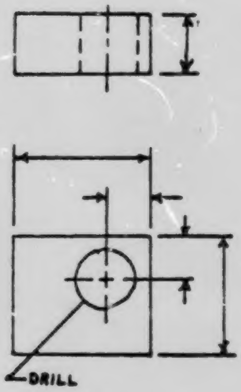


5. The best example of dimensioning the object is:

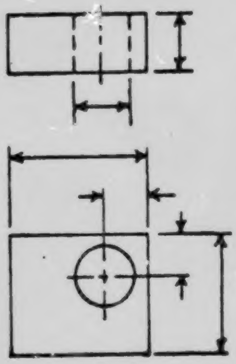
a.



b.



c.



d. all are equally as good.

6. Drawings should be made to scale, and the scale should be indicated:

a. on the object.
b. in the title block.
c. outside the border line.
d. only when smaller than full scale.

7. A fine, dark, solid line that extends from a point on the drawing to which a dimension refers is:

a. an extension line.
b. a dimension line.
c. a visible line.
d. a center line.

8. A fine, dark line composed of alternate long and short dashes used to represent axis of symmetrical parts is:

a. a dimension line.
b. a center line.
c. a hidden line.
d. a leader.

9. Arrowheads should be drawn with the length and width in a ratio of:

   a. 5:1
   b. 2:1
   c. 4:1
   d. 3:1

10. The symbol that indicates a surface is to be machined is:

    a. a boss mark.
    b. a casting mark.
    c. a forging mark.
    d. a finish mark.

79.01.06.00. B2-2
(.01-.04)

UNIT/LAP POST TEST ANSWER KEY: DIMENSIONING

1. A
2. D
3. A
4. D
5. A
6. B
7. A
8. B
9. D
10. D

File Code: 79.01.07.00.A2-1

Date Published: 12/17/75
Revised: 7/14/78

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Learning Experience Guide

UNIT: SECTION VIEWS

RATIONALE:

The common method of representing an object is by drawing its views. Whenever necessary hidden parts or edges are shown by using hidden lines. However, sometimes the hidden edges are more clearly shown by drawing a section (or cross section) view. The section view illustrates the object cut apart.

PREREQUISITES:

Unit: 79.01.06 Dimensioning

OBJECTIVE:

The students will become familiar with the terms used in sectioning. They will identify and draw the following section views; full-sections, half-sections, broken-out sections, revolved sections, removed sections, and off-set sections.

RESOURCES:

Printed Materials

Basic Technical Drawing. Spencer and Drydon, Macmillan Company, New York.
Engineering Drawing and Graphic Technology. French and Vierck, Eleventh Edition, McGraw-Hill Book Company, New York.
Mechanical Drawing. French and Svenson, Webster Division, McGraw-Hill Book Company, New York.
Technical Drawing. Sixth Edition, Gieseche, Mitchell, Spencer and Hill, Macmillan Company, New York.

Audio/Visuals

Sections - Drafting Series, Doubleday Multimedia

Equipment

As listed in the course LEG.

Principal Author(s): C. Wetterling, L. Leland, S. Vosen, J. Wheatley

Drafting Furniture: As listed in Course LEG

Player, audio cassette
Projector, filmstrip

GENERAL INSTRUCTIONS:

This unit consists of eight Learning Activity Packages (LAPs). Each LAP will provide specific information for completion of a learning activity.

The general procedure for this unit is as follows:

1) Read the first assigned Learning Activity Package (LAP).
2) Begin and complete the first assigned LAP.
3) Keep the drawing mounted on the board until it has been checked and approved by the instructors.
4) Take LAP test as instructed in each LAP.
5) Proceed to and complete the next assigned LAP in the unit.
6) Complete all required LAPs for the unit by following Steps 3, 4, and 5.
7) Take the unit post and performance tests as described in the unit LEG "Evaluation Procedures".
8) Proceed to the next assigned unit.

PERFORMANCE ACTIVITIES:

.01 Section Views Terms and Usage
.02 Half and Offset Sectioning
.03 Removed, Revolved, and Broken-Out Sectioning
.04 Section Views of a Tool Frame
.05 Section Views of a Lift Bracket
.06 Section Views of a Discharge Lock Housing
.07 Section View of a Stabilizer Bracket
.08 Section Views of a Slotted Disc

EVALUATION PROCEDURE:

1. The student completes LAPs and takes the LAP tests as required.

2. The student takes a multiple-choice post test and turns it in for correction.

3. The student takes a unit performance test. Successful unit completion is meeting the listed criteria for the performance test.

FOLLOW-THROUGH:

Whenever it will become necessary to show the interior parts of an object, section views will be used and monitored throughout the course.

Begin the first assigned Learning Activity Package (LAP).

Student: ____________________ File Code: 79.01.07.00. A2-2 (.01-.08)

Date: ____________________ Date Published: 6/20/74

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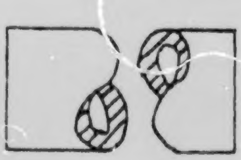
UNIT/LAP PRETEST: SECTION VIEWS

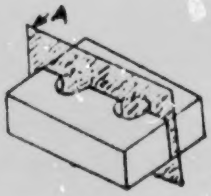
1. The illustration below represents a break in a long piece of:

   a. round solid material.
   b. elliptical tubular material.
   c. elliptical solid material.
   d. round tubular material.



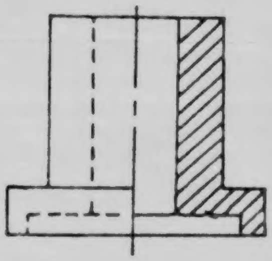
2. The sectional view produced according to plane A below would be:

   a. an alternate section.
   b. a half section.
   c. an auxiliary section.
   d. a full section



3. The sectional view illustrated below is:

   a. a full section.
   b. a one-fourth section.
   c. a broken-out section.
   d. a half section.



4. A half section is obtained when:

   a. three-quarter of the piece is cut out and removed.
   b. one-half of the piece is cut out and removed.
   c. one-quarter of the piece is cut out and removed.
   d. one-third of the piece is cut out and removed.

5. A convenient means of showing the shape of a rib, arm, or long feature is:

   a. a half section.
   b. a revolved section.
   c. a full section.
   d. a broken section.

6. The type of view that shows interior features of an object is:

   a. a sectional view.
   b. a top view.
   c. an auxiliary view.
   d. an end view.

7. A view obtained by passing a cutting plane completely through an object is:

   a. a full section.
   b. a half section.
   c. a revolved section.
   d. a removed section.

8. The direction of sight for a sectional view is indicated by:

   a. the arrows at the ends of the cutting plane.
   b. the position of the front view.
   c. the length of the projectors.
   d. the direction of the section lines.

9. On detail drawings, the ASA recommends that all materials be represented by the section lining for:

   a. aluminum.
   b. cast-iron.
   c. wood.
   d. plastic.

10. The pencil lead to use for drawing section lines is:

   a. B or 2B.
   b. 4H or 6H.
   c. H or 2H.
   d. 4B or 6B.

79.01.07.00. A2-2
(.01-.08)

UNIT/LAP PRETEST ANSWER KEY: SECTION VIEWS

1. D
2. A
3. D
4. C
5. B
6. A
7. A
8. A
9. B
10. B

File Code: 79.01.07.01.A2-0

Date Published: 12/17/75

Revised: 7/14/78

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Learning Activity Package

Student: ____________________

Date: ____________________

PERFORMANCE ACTIVITY: Sectional Views; Terms and Usage

OBJECTIVE:

Understand the reason for sectioning and draw the given objects in full section.

EVALUATION PROCEDURE:

Instructor will examine drawings against a prepared key for accuracy, dimensioning, line construction, neatness and lettering. No more than three errors will be allowed.

RESOURCES:

Technical Drawing -- 7-1 page 203 -- to -- 7-8 page 211.
Basic Technical Drawing, Chapter 11.
Mechanical Drawing, Chapter 10.

Sections, Drafting Series.

Basic Drafting Tools: (See Unit LEG)
Drafting Furniture: (See Unit LEG)
Filmstrip projector
Audio cassette player

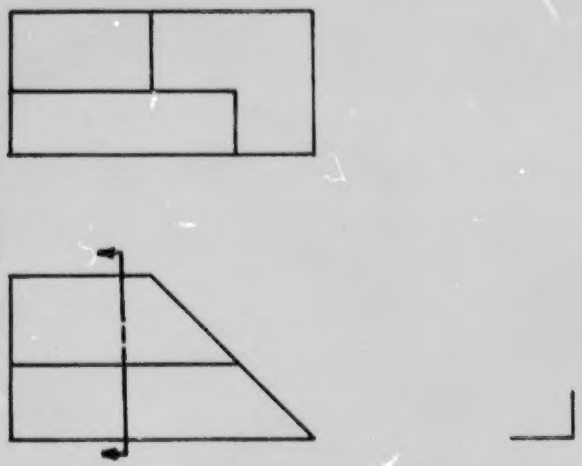
PROCEDURE:

1. Read the above resource(s).
2. View the filmstrip on Sections.
3. On the back of this sheet, letter the definitions listed.
4. Draw the section views given on the three assignment sheets.
5. Have your drawings evaluated.
6. Take the LAP test after LAP 03.

Principal Author(s): Q. Fogleman, S. Vosen, J. Wheatley

Draw the full section indicated on each

1.



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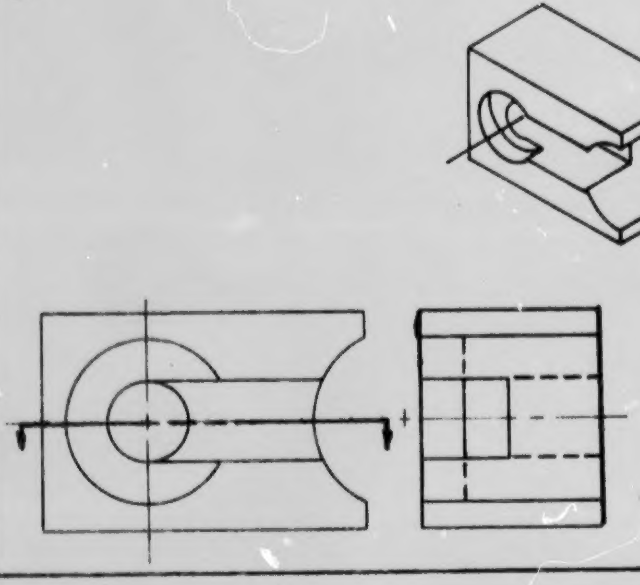

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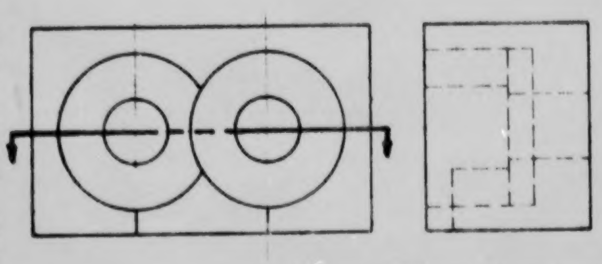

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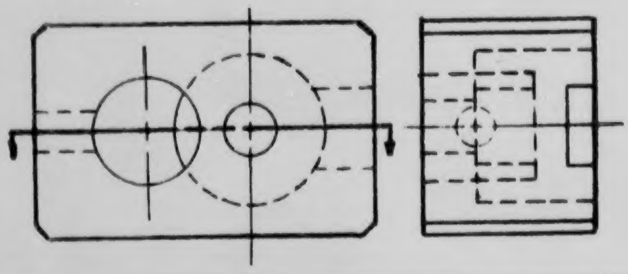

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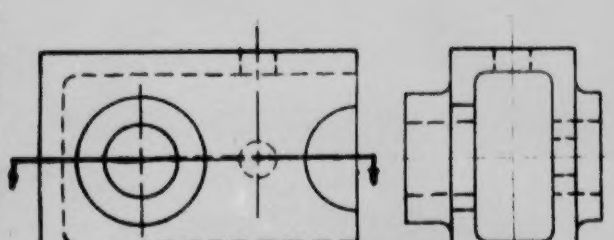

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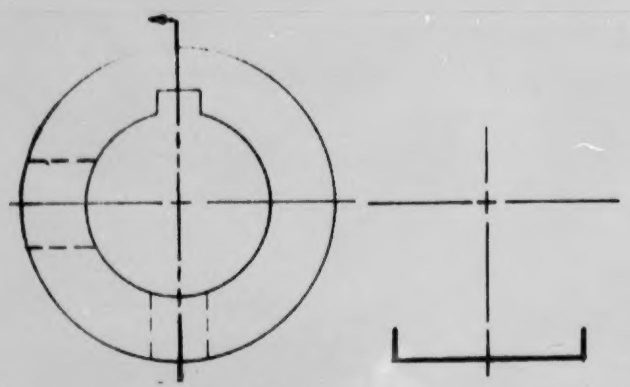

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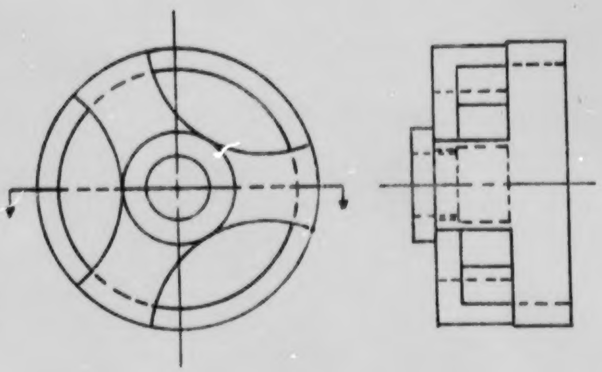

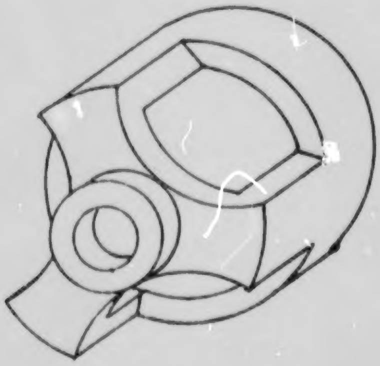

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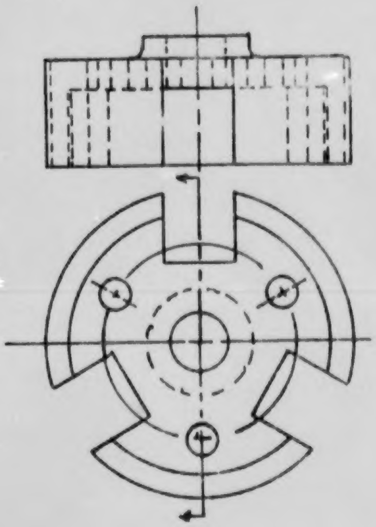

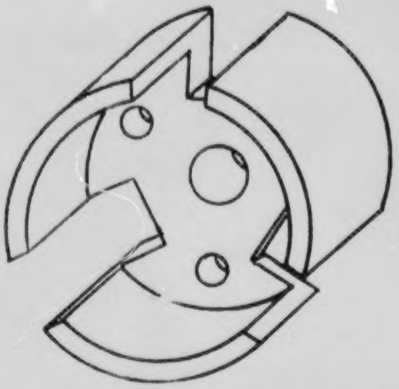

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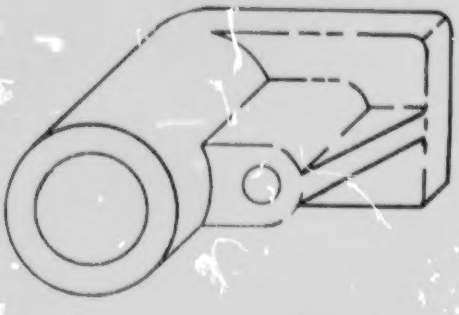

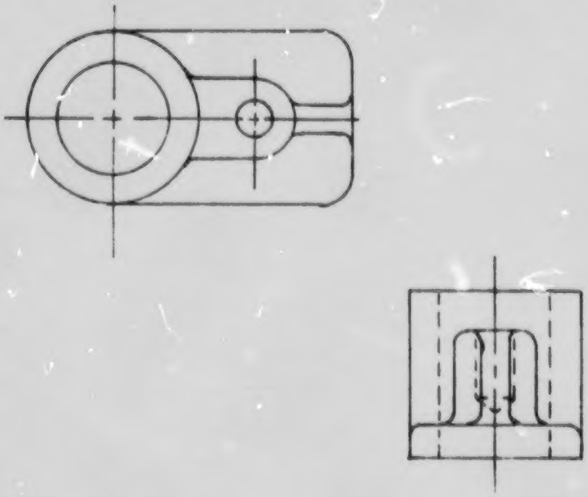

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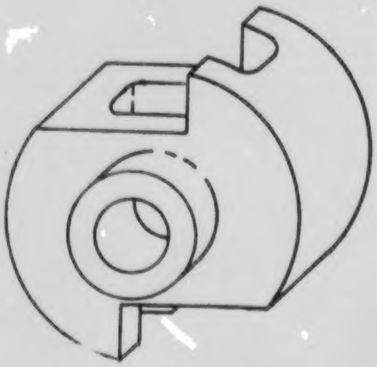

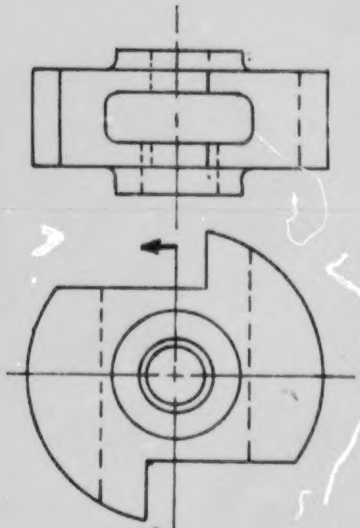

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File Code: 79.01.07.02.A2-0

Date Published: 12/17/75
Revised: 3-19-79

Learning Activity Package

Student: __________

Date: __________

PERFORMANCE ACTIVITY: Half and Off-Set Sectioning

OBJECTIVE:

Draw the half and off-set section views of various objects.

EVALUATION PROCEDURE:

Instructor will examine drawings against a prepared key for accuracy, dimensioning, line construction, neatness and lettering. No more than three errors will be allowed.

RESOURCES:

Basic Technical Drawing, Chapter 11. Paragraphs 11.4 and 11.8
Mechanical Drawing, Chapter 10.
Technical Drawing, Chapter 7.

Basic Drafting Tools: (See Unit LEG)
Drafting Furniture: (See Unit LEG)

PROCEDURE:

1. Draw the indicated section views of all machined objects shown on the assignment sheets listed in the above resources(s).

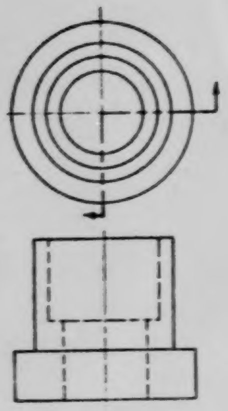
   NOTE: Use the resource books as references to complete the drawings if necessary.

2. Have the instructor evaluate the drawings.

3. Take LAP test after LAP 03.

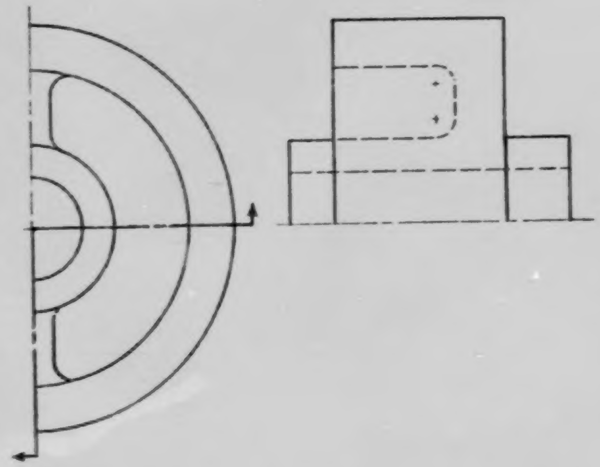
Principal Author(s): Q. Fogleman, S. Vosen, J. Wheatley

Draw the half sections indicated on the objects below. 79.01.07.02 pg. 2

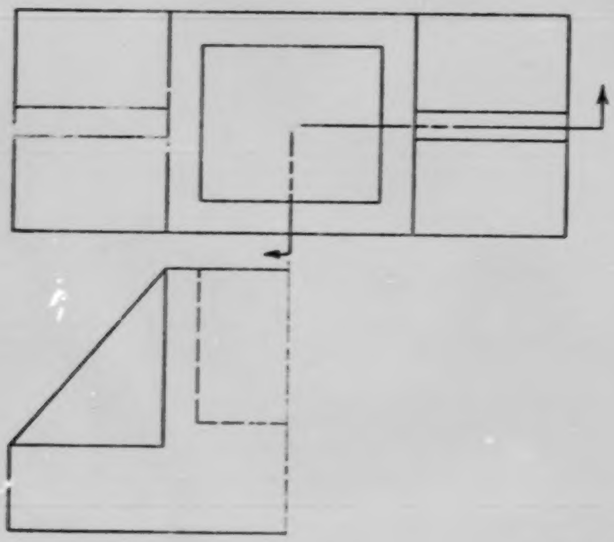


Draw the half section on the object.

PULLEY



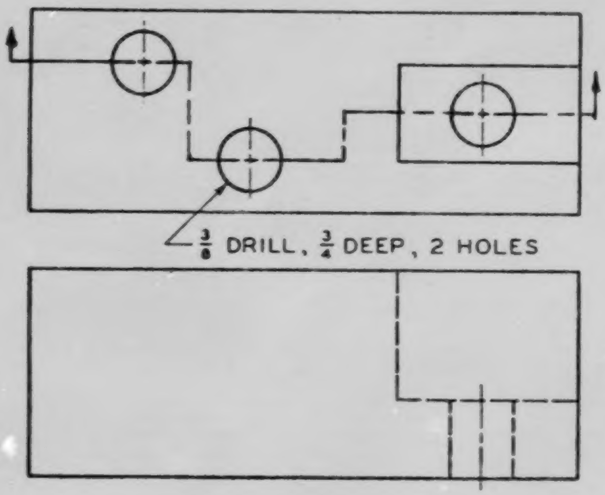
SUPPORT BOX



Draw the offset sections indicated on the objects below.

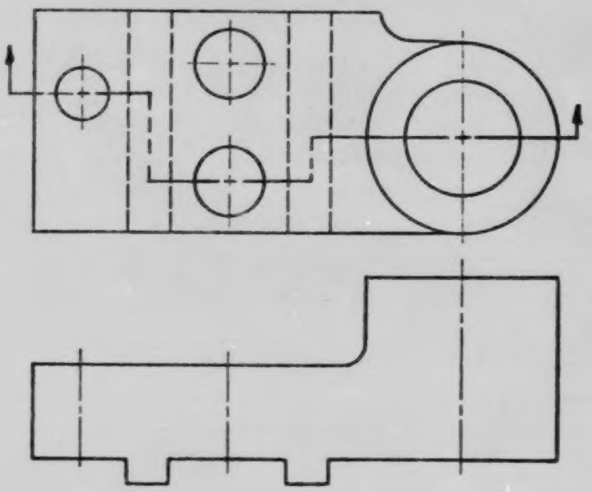
LEVER SLOT

CONVERT THE FRONT VIEW INTO AN OFFSET SECTION.


$\frac{3}{8}$ DRILL, $\frac{3}{4}$ DEEP, 2 HOLES

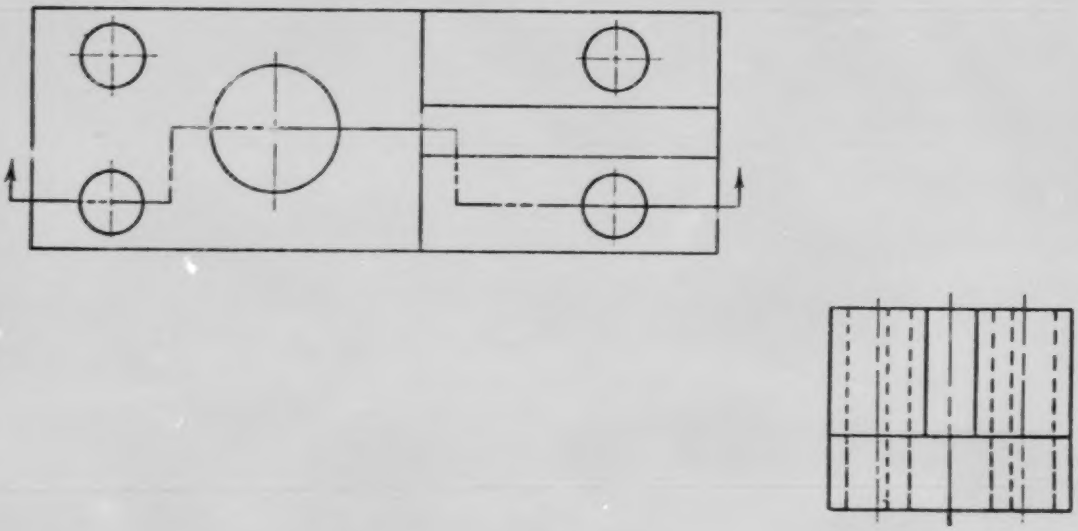
SHAFT GUIDE

CONVERT THE FRONT VIEW TO AN OFFSET SECTION.



GUIDE MOUNT

(Draw the offset section)



Mountain-Plains Education &
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Program, Inc.
Glasgow AFB, Montana 59231

File Code: 79.01.07.03.A2-0

Date Published: 12/17/75

Revised: 3-19-79

Learning Activity Package

Student: __________

Date: __________

PERFORMANCE ACTIVITY: Removed, Revolved, and Broken-Out Section Views

OBJECTIVE:

Draw the indicated section views of the assigned objects.

EVALUATION PROCEDURE:

Instructor will examine drawings against a prepared key for accuracy, dimensioning, line construction, neatness and lettering. No more than three errors will be allowed.

RESOURCES:

Basic Technical Drawing, Chapter 11, page 197.
Mechanical Drawing, Chapter 10.
Engineering Drawing and Graphic Technology, Chapter 8.

Basic Drafting Tools: (See Unit LEG)
Drafting Furniture: (See Unit LEG)

PROCEDURE:

1. Draw the indicated section views of the given objects on the assignment sheet.

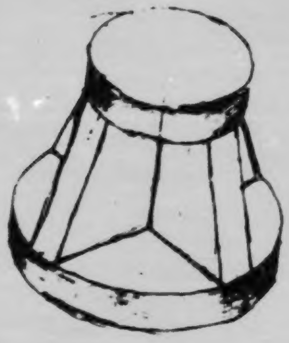
   NOTE: You may use the resource books as references to complete the drawings.

2. Have the instructor evaluate the drawings.

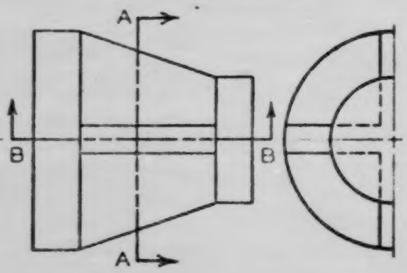
3. Take the LAP test over LAPs .01, .02, and .03.

Principal Author(s): Q. Fogleman, S. Vosen, J. Wheatley

Draw the removed sections indicated on the STOOL PIECE. COMPLETE THE SECTIONS INDICATED.

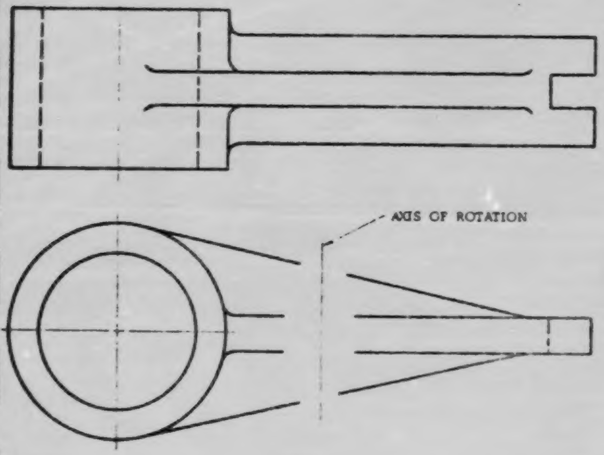


SECTION A-A

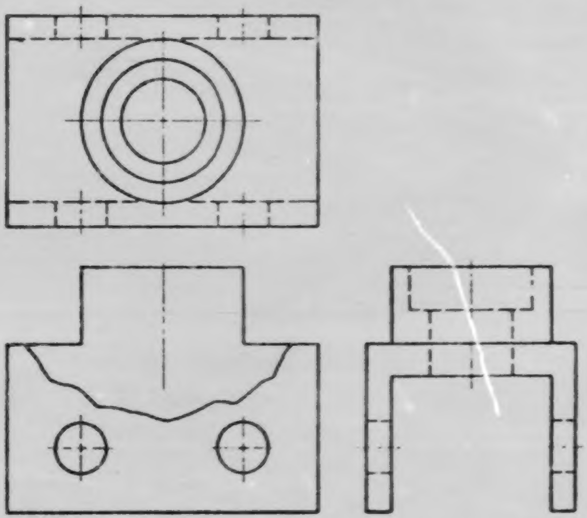


SECTION B-B

Draw the revolved section indicated on the CRANK ARM.



Draw the broken-out section of the SLIDE. COMPLETE THE BROKEN OUT SECTION IN THE FRONT VIEW.



File Code: 79.01.07.04.A2-0

Date Published: 12/17/75

Date Revised: 7-12-78

Mountain-Plains Education &
Economic Development
Program, Inc.
Glasgow AFB, Montana 59231

Learning Activity Package

Student: ____________________

Date: ____________________

PERFORMANCE ACTIVITY: Section Views of a Tool Frame

OBJECTIVE:

Draw the various section views of a tool frame.

EVALUATION PROCEDURE:

Instructor will examine drawings against a prepared key for accuracy, dimensioning, line construction, neatness and lettering. No more than three errors will be allowed.

RESOURCES:

Technical Drawing, Chapter 7
Basic Technical Drawing, Chapter 11
Mechanical Drawing, Chapter 10
Engineering Drawing and Graphic Technology, Chapter 8
Basic Drafting Tools: (See Unit LEG)
Drafting Furniture: (See Unit LEG)

PROCEDURE:

1. Draw the indicated section views of a tool frame shown on the assignment sheet.

   NOTE: You may use the resource books as references to complete the drawings.

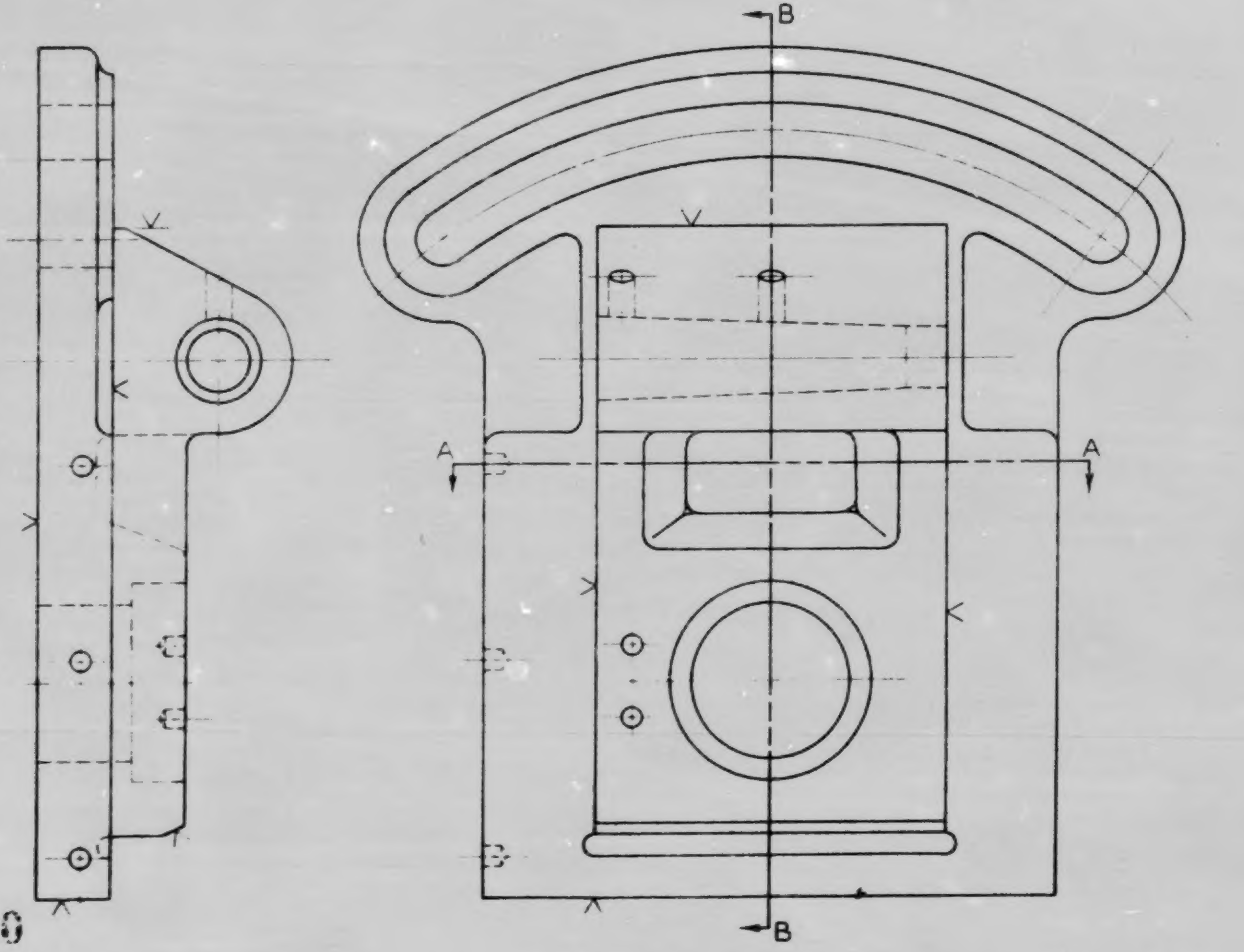
2. Have the instructor evaluate the drawings.

Principal Author(s): Q. Fogleman, J. Wheatley

SECT A-A

TOOL FRAME

Draw indicated sections



SECTIONAL VIEWS

79.01.07.04.A1

SECT B-B

320

3

BOTTOM OF DRAWING

File Code: 79.01.07.05.A2-0

Date Published: 12/17/75
Revised: 7-12-78

Mountain-Plains Education &
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Glasgow AFB, Montana 59231

Learning Activity Package

Student: ____________________

Date: ____________________

PERFORMANCE ACTIVITY: Section Views of a Lift Bracket

OBJECTIVE:

Draw the various section views of a lift bracket.

EVALUATION PROCEDURE:

Instructor will examine drawings against a prepared key for accuracy, dimensioning, line construction, neatness and lettering. No more than three errors will be allowed.

RESOURCES:

Basic Technical Drawing, Chapter 11.
Mechanical Drawing, Chapter 10
Technical Drawing, Chapter 7
Basic Drafting Tools: (See Unit LEG)
Drafting Furniture: (See Unit LEG)
Engineering Drawing and Graphic Technology, Chapter 8

PROCEDURE:

1. Draw the indicated section views of a lift bracket shown on the assignment sheet.

   NOTE: You may use the resource books as references to complete the drawings.

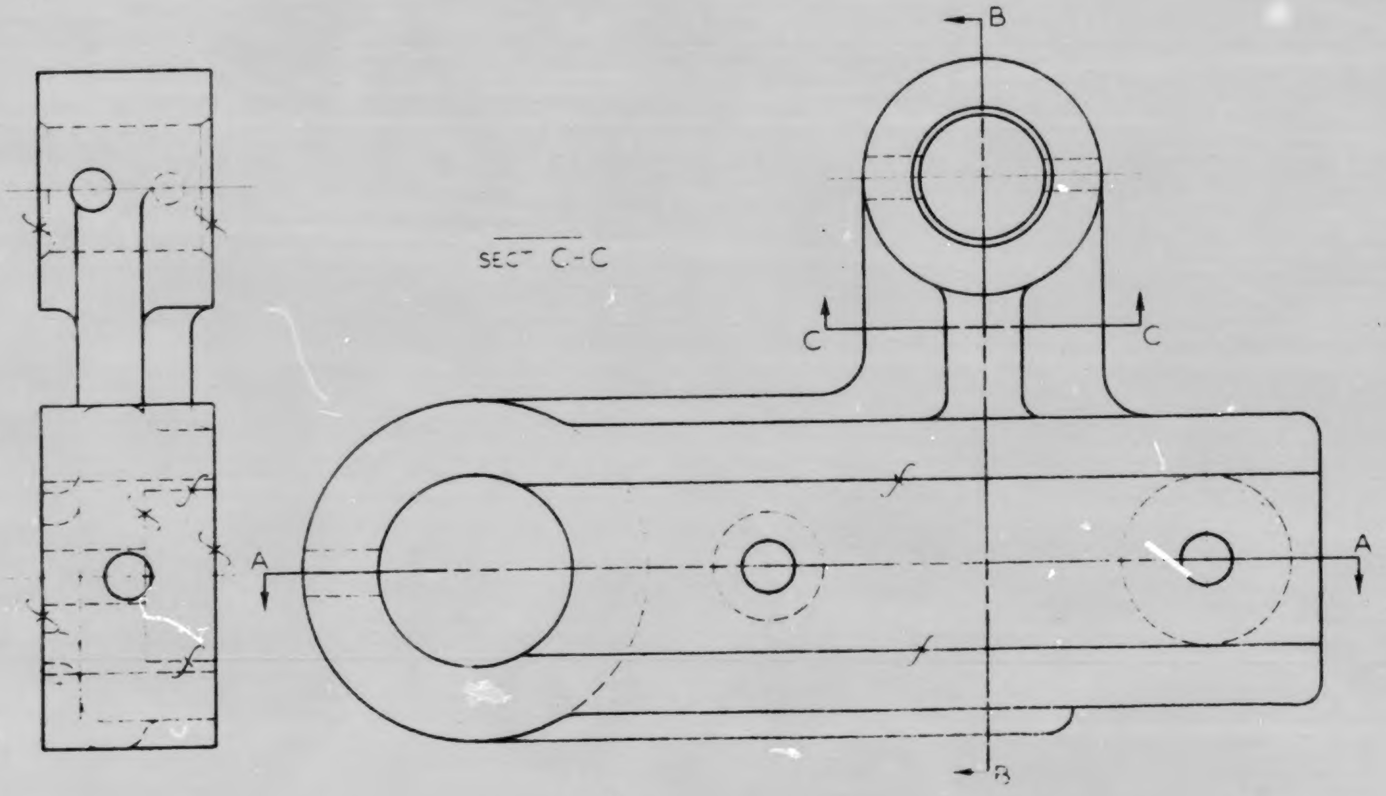
2. Have the instructor evaluate the drawings.

Principal Author(s): C. Wetterling, J. Wheatley

LIFT BRACKET. Draw indicated sections

SECT A-A

SECT C-C



SECT B-B

File Code: 79.01.07.06.A2-0

Date Published: 12/17/75

Revised: 7/12/78

Mountain-Plains Education &
Economic Development
Program, Inc.
Glasgow AFB, Montana 59231

Learning Activity Package

Student: ____________

Date: ____________

PERFORMANCE ACTIVITY: Section Views of a Discharge Lock Housing

OBJECTIVE:

Draw the various section views of a discharge lock housing.

EVALUATION PROCEDURE:

The instructor will examine drawings against a prepared key for accuracy, dimensioning, line construction, neatness and lettering. No more than three errors will be allowed.

RESOURCES:

Technical Drawing, Chapter 7.
Basic Technical Drawing, Chapter 11.
Mechanical Drawing, Chapter 10
Engineering Drawing and Graphic Technology, Chapter 8.
Basic Drafting Tools: (See Unit LEG)
Drafting Furniture: (See Unit LEG)

PROCEDURE:

1. Draw the indicated section views of a discharge lock housing shown on the assignment sheet.

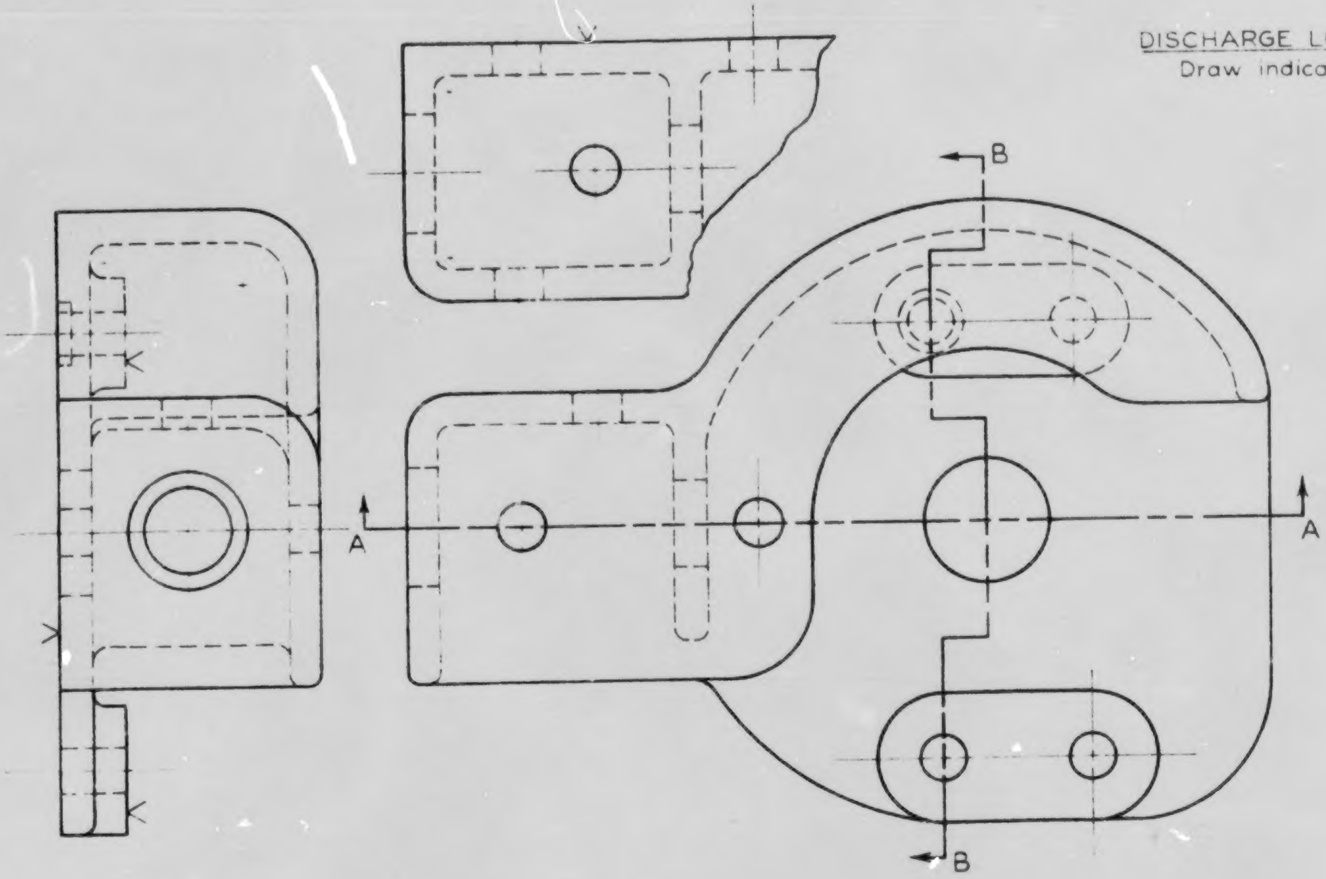
   NOTE: You may use the resource books as references to complete the drawings.

2. Have the instructor evaluate the drawings.

Principal Author(s): Q. Fogleman, J. Wheatley

DISCHARGE LOCK HOUSING

Draw indicated sections.



SECT B-B

SECT A-A

BOTTOM OF DRAWING

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Glasgow AFB, Montana 59231

File Code: 79.01.07.07.A2-0

Date Published: 12/17/75

Revised: 7/13/78

Learning Activity Package

Student: ____________________

Date: ____________________

PERFORMANCE ACTIVITY: Section View of a Stabilizer Bracket

OBJECTIVE:

Draw a section view of a stabilizer bracket.

EVALUATION PROCEDURE:

Instructor will examine drawings against a prepared key for accuracy, dimensioning, line construction, neatness and lettering. No more than three errors will be allowed.

RESOURCES:

Technical Drawing, Chapter 7
Basic Technical Drawing, Chapter 11
Mechanical Drawing, Chapter 10
Engineering Drawing and Graphic Technology, Chapter 8
Basic Drafting Tools: (See Unit LEG)
Drafting Furniture: (See Unit LEG)

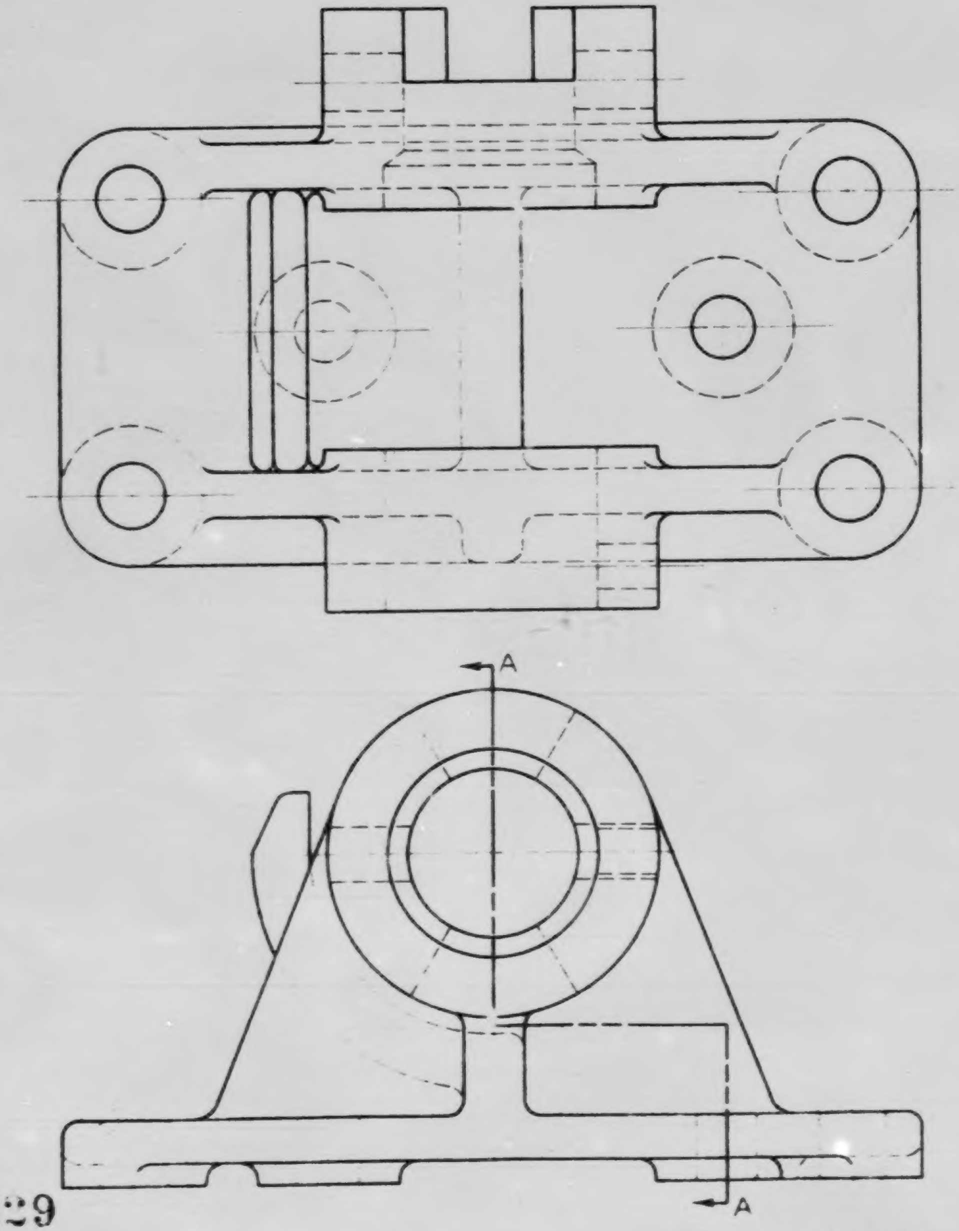
PROCEDURE:

1. Draw the indicated section views of a stabilizer bracket shown on the assignment sheet.

   NOTE: You may use the resource books as references to complete the drawings.

2. Have the drawings evaluated by the instructor.

Principal Author(s): Q. Fogleman, J. Wheatley



STABILIZER BRACKET

Draw indicated section

SECTIONAL VIEWS

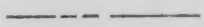
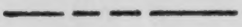
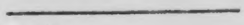
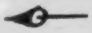
BOTTOM OF DRAWING

Student: ____________________ File Code: 79.01.07
LAPS (01-03)
Date: ____________________ Date Published: 7-20-78

Family Education Program

LAP TEST: SECTION VIEWS

1. The edge view of the cutting plane is represented by which line.

   a. 
   b. 
   c. 
   d. 

2. The direction of sight for a sectional view is indicated by:

   a. the arrows at the ends of the cutting plane.
   b. the position of the front view.
   c. the length of the projectors.
   d. the direction of the section line.

3. In a section view, all visible edges and contours behind the cutting plane:

   a. are not shown.
   b. are high-lighted.
   c. should be shown.
   d. should be removed.

4. A section view in which the cutting plane has passed through the entire object:

   a. is never used.
   b. is an edge view.
   c. is a half view.
   d. is a full section.

5. When a section of the object is drawn adjacent to the view, it is called a(n):

   a. removed section.
   b. revolved section.
   c. aligned section.
   d. rotated section.

6. The sectional view produced according to plane D in Figure 67 would be:

   a. a full section.
   b. a partial section.
   c. a half section.
   d. a broken-out section.

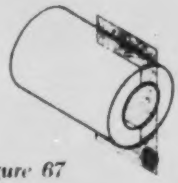
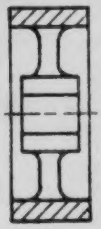


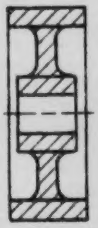
Figure 67

7. The best sectional view of the object below is:

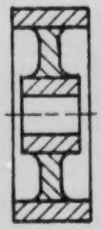
a.



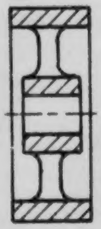
b.

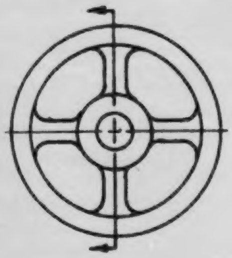


c.



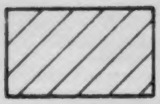
d.



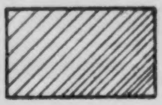


8. The best illustration of section lining below is:

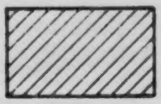
a.



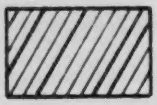
b.



c.



d.



9. The sectional view produced according to plane B in Figure 60 would be:

a. an alternate section.
b. a broken-out section.
c. an offset section.
d. a double section.

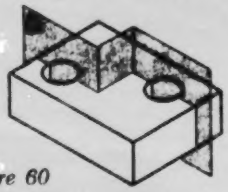
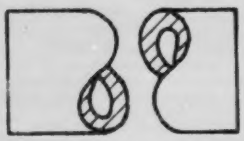


Figure 60

10. The illustration in Figure 59 represents a break in a long piece of:

a. round solid material.
b. round tubular material.
c. elliptical tubular material.
d. elliptical solid material.

Figure 59



LAP TEST ANSWER KEY: SECTION VIEWS

1. B
2. A
3. C
4. D
5. A
6. D
7. D
8. C
9. C
10. B

File Code: 79.01.07.08.A2-0

Date Published: 12/17/75
Revised: 7/13/78

Mountain-Plains Education &
Economic Development
Program, Inc.
Glasgow AFB, Montana 59231

Learning Activity Package

Student: ____________________

Date: ____________________

PERFORMANCE ACTIVITY: Section Views of a Slotted Disc

OBJECTIVE:

Draw the various section views of a slotted disc.

EVALUATION PROCEDURE:

The instructor will examine drawings against a prepared key for accuracy, dimensioning, line construction, neatness and lettering. No more than three errors will be allowed.

RESOURCES:

Technical Drawing, Chapter 7
Basic Technical Drawing, Chapter 11.
Mechanical Drawing, Chapter 10.
Engineering Drawing and Graphic Technology, Chapter 8.
Basic Drafting Tools: (See Unit LEG)
Drafting Furniture: (See Unit LEG)

PROCEDURE:

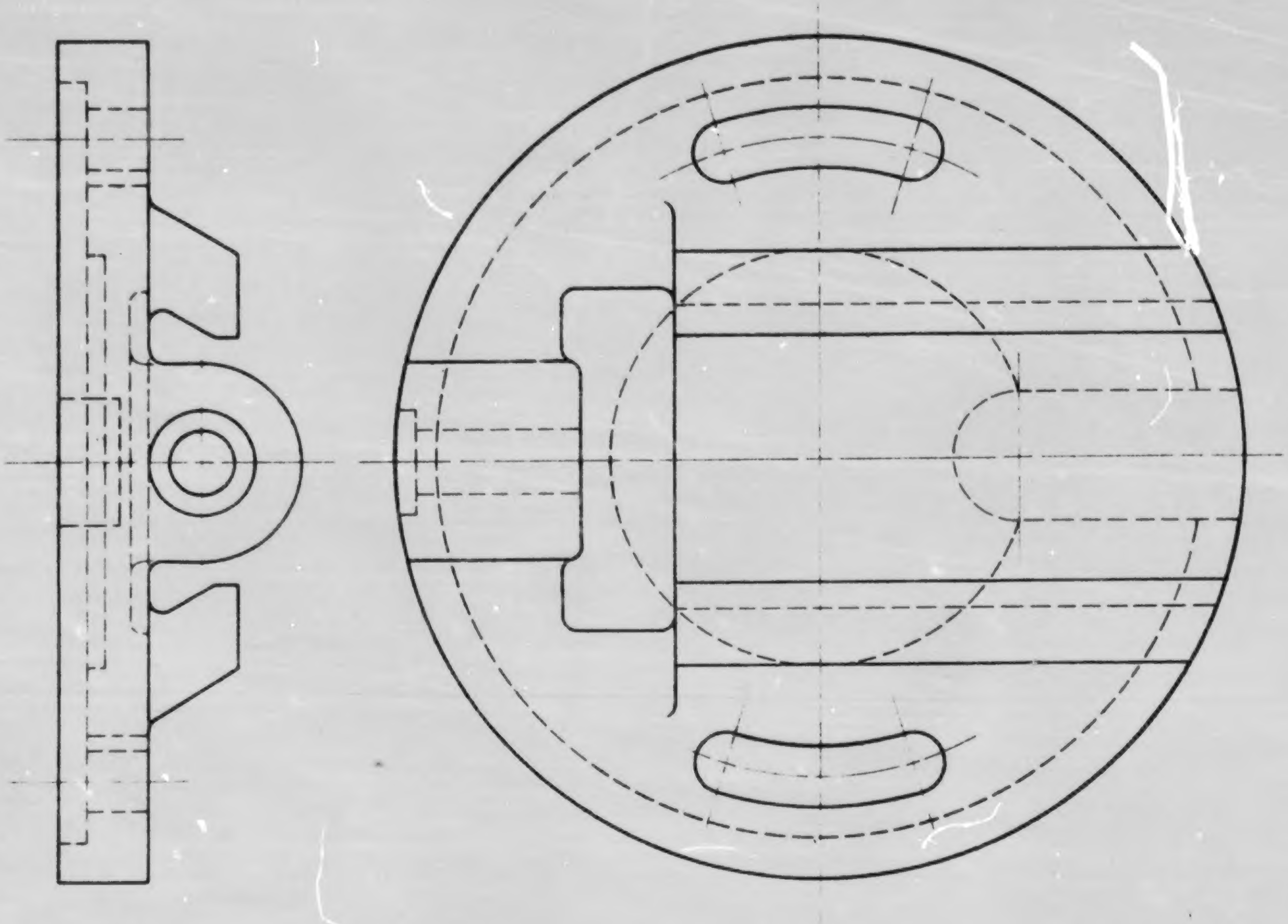
1. Draw the indicated section views of a slotted disc shown on the assignment sheet.

   NOTE: You may use the resource books as references to complete the drawings.

2. Have the instructor evaluate the drawings.

Principal Author(s): Q. C. Wetterling, J. Wheatley

SECTIONAL VIEWS



HALF SECTION

FULL SECTION

SLOTTED DISC

Draw indicated sections.

79.01.07.08.A2-0

Student: ______________________

Date: ______________________

File Code: 79.01.07.00. B2-2

Date Published: 6/21/74

Revised: 12-3-79

Mountain-Plains Education &
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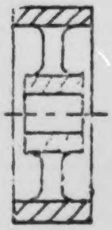
Program, Inc.
Glasgow AFB, Montana 59231

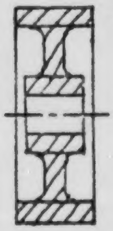
UNIT POST TEST: SECTION VIEWS

1. The best sectional view of the object at right is:

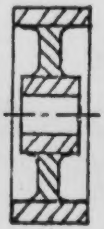
A



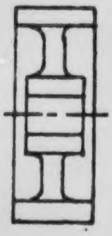
B

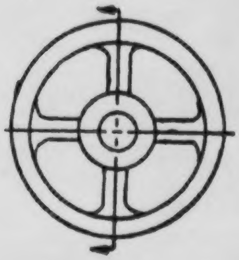


C



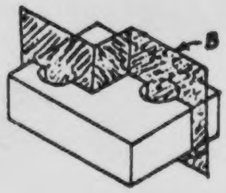
D





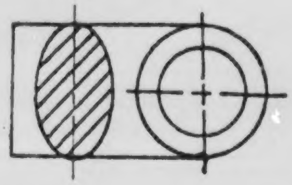
2. The sectional view produced according to plane B below would be:

   a. an alternate section.
   b. a broken-out section.
   c. a double section.
   d. an offset section.



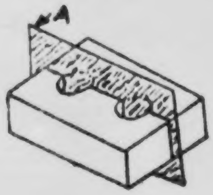
3. The sectional view illustrated below is:

   a. a turned section.
   b. a removed section.
   c. a revolved section.
   d. a center section.

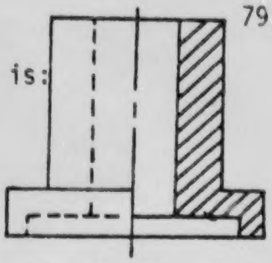


4. The sectional view produced according to plane A below would be:

   a. an alternate section.
   b. a half section.
   c. an auxiliary section.
   d. a full section.



5. The sectional view illustrated at the right is:



   a. a full section.
   b. a one-fourth section.
   c. a broken-out section.
   d. a half section.

6. Which type of line should not be drawn on sectional views except as needed for dimensioning or clarity?

   a. center
   b. visible.
   c. hidden
   d. break

7. When a cutting plane passes through a rib or web parallel to the flat side:

   a. the sectioning is drawn at the opposite angle.
   b. the sectioning is omitted.
   c. the sectioning is drawn vertically.
   d. the sectioning is drawn horiztonally.

8. Which type of section shows the shape of the object without an additional view:

   a. a full section.
   b. off set section.
   c. a revolved section.
   d. a removed section.

9. The direction of sight for a sectional view is indicated by:

   a. the arrows at the ends of the cutting plane.
   b. the position of the front view.
   c. the length of the projectors.
   d. the direction of the section line.

10. Sectional views are usually used to show:

   a. fine line detail.
   b interior details.
   c. exterior details.
   d. none of the above.

UNIT POST TEST ANSWER KEY: SECTION VIEWS

1. A
2. D
3. C
4. D
5. D
6. C
7. B
8. C
9. A
10. B

Student: ____________________ File Code: 79.01.07.00.A1-5

Date: ____________________ Date Published: 11/6/74

Revised: 7/13/78

Family Pay Number: __________ Sex: M F (Circle one)

Mountain-Plains Education &
Economic Development
Program, Inc.
Glasgow AFB, Montana 59231

UNIT PERFORMANCE TEST: SECTION VIEWS

OBJECTIVE 1:

Given an illustration of a machined object, the student will draw an off-set section view and a full section view with an aligned detail.

OBJECTIVE 2:

The student will be able to cross-section all parts of the object that have been cut by sections AA and BB.

OBJECTIVE 3:

The student will be able to draw section views that are clean and neat.

OBJECTIVE 4:

The student will be able to draw section views having all lines accurately and properly projected.

TASK:

The student will be given an illustration of a machined object. He will then draw 2 section views of the object. He must cross-section all parts cut by sections AA and BB.

ASSIGNMENT:

Draw the "Column Base Housing" section views found on the attached sheet.

CONDITIONS:

The drawing is to be completed in a typical drafting room setting, using the complete facilities.

The student will not be able to use the instructor(s) or other students as a resource.

RESOURCES:

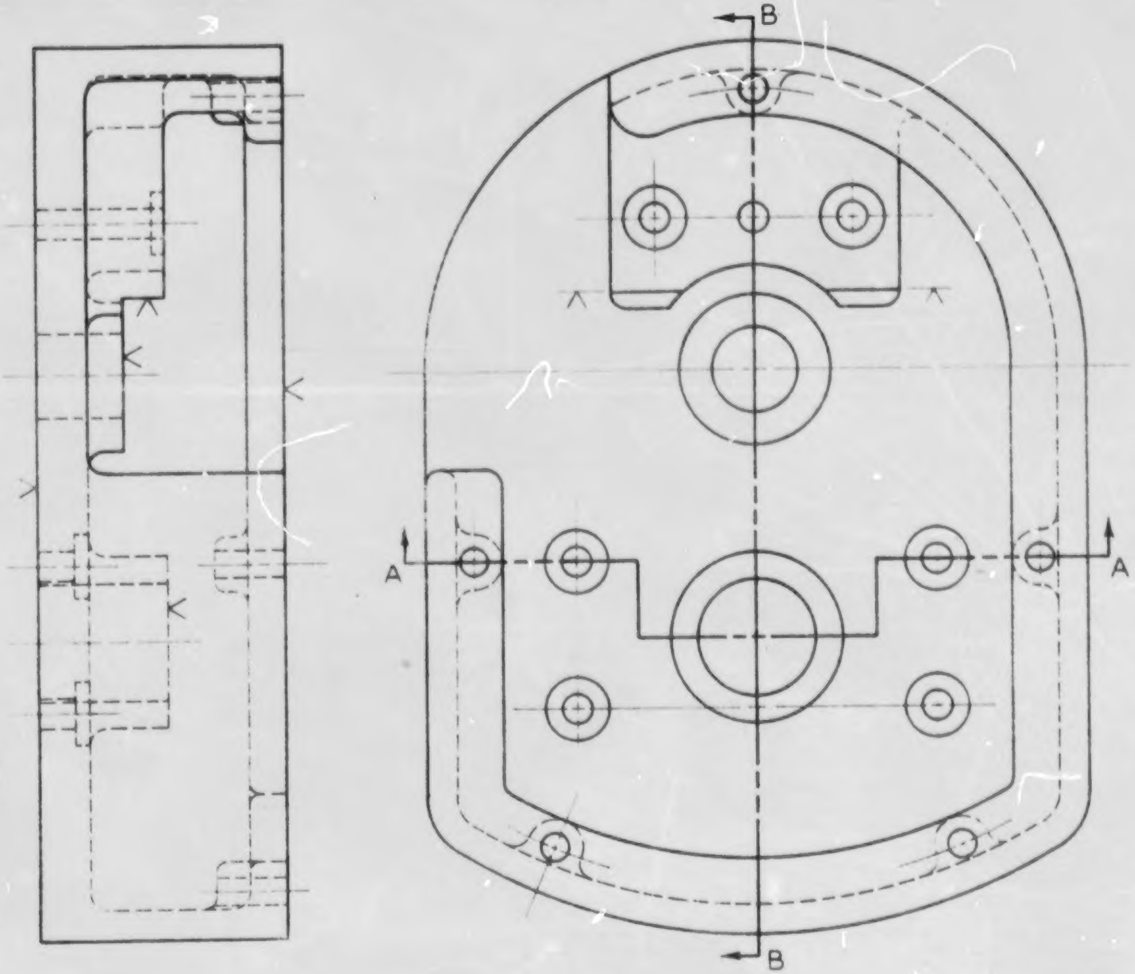
As listed in the Unit LEG.

SECTION

DRAWN BY:

SHEET 51

SECTIONAL VIEWS Unit 7 PERFORMANCE TEST



SECT B-B

COLUMN BASE HOUSING

Draw indicated sections.

SECT A-A

BOTTOM OF DRAWING

341

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Glasgow AFB, Montana 59231

Student: ______________________ File Code: 79.01.07.00.A1-5

Date: ______________________ Date Published: 11/6/74

Family Pay Number: __________ Sex: M F (Circle 1)

PERFORMANCE CHECKLIST:

OVERALL PERFORMANCE: Satisfactory _____ Unsatisfactory _____

	CRITERION Met	 Not Met
Objective 1:		
1. Both section views are completely drawn.		
Criterion: No object lines are missing		
Objective 2:		
2. All parts of the object cut by section lines AA and BB		
are cross-sectioned		
Criterion: No cross-section lines are missing		
Objective 3:		
3. Drawing is clean and neat		
Criterion: (ASA Standards), Technical Drawing, pp. 12 and 22		
Objective 4:		
4. All object lines are accurately projected from given views		
Criterion: Within 1/64"		
5. All cross-section lines are correct		
Criterion: 1/8" apart on 45^{0} angle		

	CRITERION	
	Met	Not Met
6. The drawing is completed within the specified time limit		
Criterion: Not to exceed 3-1/2 hours		
The student must meet criterion on 5 line items to obtain an overall score of		
satisfactory.		

Family Education Program

File Code: 79.01.09.05.A2-0

Date Published: 3-30-78
Revised: 1-16-80

Learning Activity Package

Student: ____________________

Date: ____________________

PERFORMANCE ACTIVITY: Primary and Secondary Auxiliary Views of an Object

OBJECTIVE:

Draw the Primary and Secondary Auxiliary views of an object.

EVALUATION PROCEDURE:

Instructor will examine drawings for accuracy, neatness, line work and lettering. No errors will be allowed on this assignment.

RESOURCES:

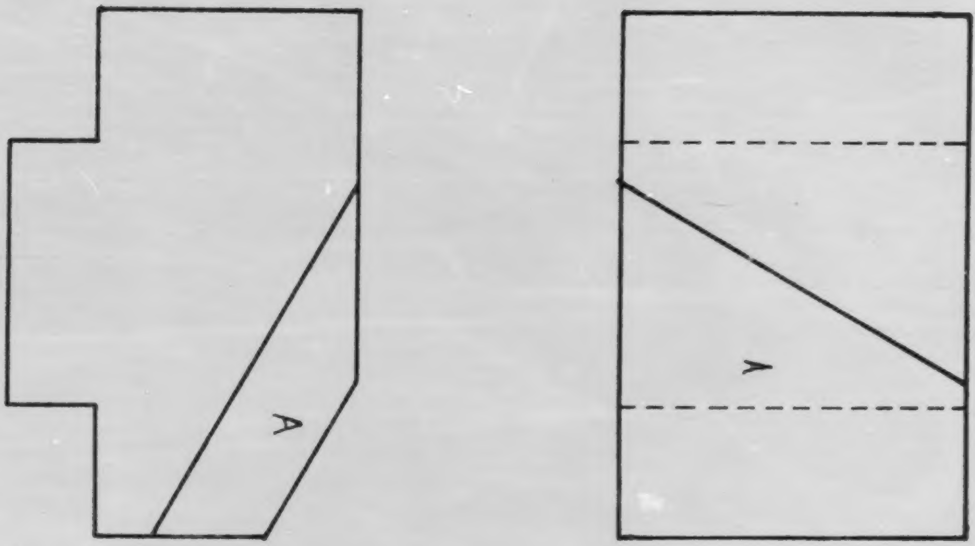
Basic Technical Drawing, Chapter 12 -- 12.12.
Mechanical Drawing, Chapter 9.
Technical Drawing, Chapter 8 -- 8.19.
Design Drafting, Chapter 10 -- pg. 245.

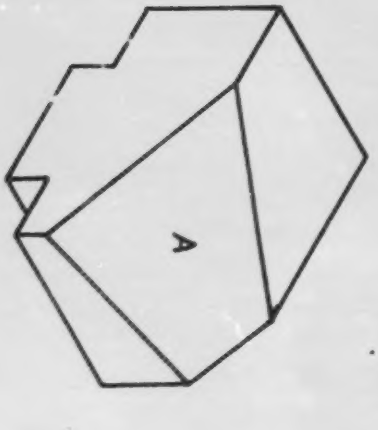
Basic Drafting Tools: (See Unit LEG)
Drafting Furniture: (See Unit LEG)

PROCEDURE:

1. Draw the primary auxiliary view of the object shown on the attached assignment sheet. (HINT: You must obtain an edge view of surface "A".) Look at your resources. (Also, draw all hidden lines.)
2. Draw a secondary auxiliary view of the entire object to show a true size and shape. Draw all visible and hidden lines. Use the suggested resources.
3. Have your drawings evaluated by the instructor.
4. Take the LAP test and proceed to the Performance Test.

Principal Author(s): J. Wheatley, S. Vosen


A
A


A

File Code: 79.01.09.04.A2-0

Date Published: 3-30-78
Revised: 1-15-80

Family Education Program

Learning Activity Package

Student: ____________________

Date: ____________________

PERFORMANCE ACTIVITY: Right Side, Auxiliary and Auxiliary Section Views

OBJECTIVE:

Draw the right end and auxiliary view of an Alignment Cam. Draw a sectioned auxiliary view of a Slotted Base.

EVALUATION PROCEDURE:

Instructor will examine drawings for accuracy, neatness and line work. No errors will be allowed in this assignment.

RESOURCES:

Basic Technical Drawing, Chapter 12 -- 12.10.
Mechanical Drawing, Chapter 9 -- 9.11.
Technical Drawing, Chapter 8 -- 8.7, 8.17.

Basic Drafting Tools: (See Unit LEG)
Drafting Furniture: (See Unit LEG)

PROCEDURE:

1. Draw the right end and auxiliary view of the Alignment Cam as indicated on the attached drawing assignment sheet.
2. Draw the auxiliary section of the Slotted Base.
3. Have your drawings evaluated by the instructor.
4. Take the combined LAP test and then proceed to LAP .05.

Principal Author(s): S. Vosen, J. Wheatley

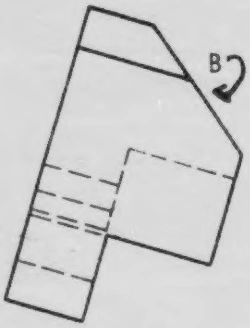
AUXILIARY VIEWS

79.01.09.04

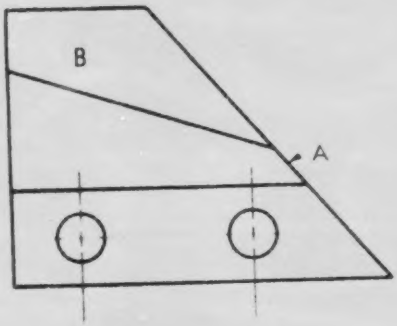
①

ALIGNMENT CAM

Draw complete auxiliary view
showing true size of surface A.
Draw right side view.



L.S. Auxiliary

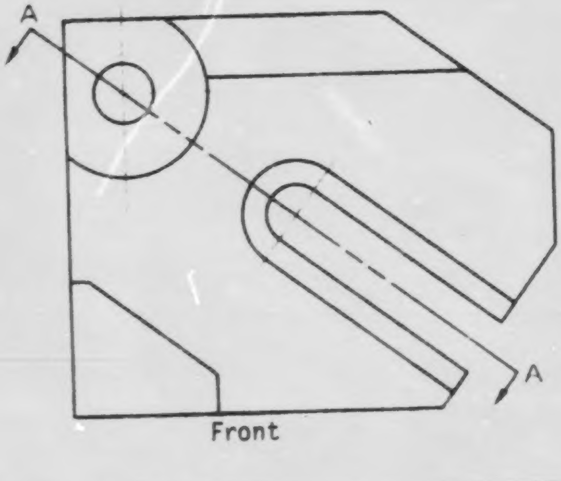


R.S. VIEW HERE

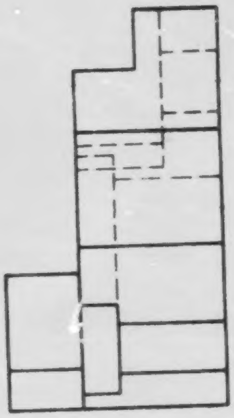
②

SLOTTED BASE

Draw auxiliary section A-A



Front



R.S.

Family Education Program

File Code: 79.01.09.03.A2-0

Date Published: 12-17-75
Revised: 1-16-80

Learning Activity Package

Student: ____________________

Date: ____________________

PERFORMANCE ACTIVITY: Auxiliary Views of Machined Objects

OBJECTIVE:

Given various drawings of machined objects, draw a specified auxiliary view.

EVALUATION PROCEDURE:

Instructor will examine drawings for accuracy, neatness, line work and lettering. No errors will be allowed on this assignment.

RESOURCES:

Basic Technical Drawing, Chapter 12 -- 12.7, 12.8.
Mechanical Drawing, Chapter 9 -- 9.9.
Technical Drawing, Chapter 8 -- 8.11, 8.12.

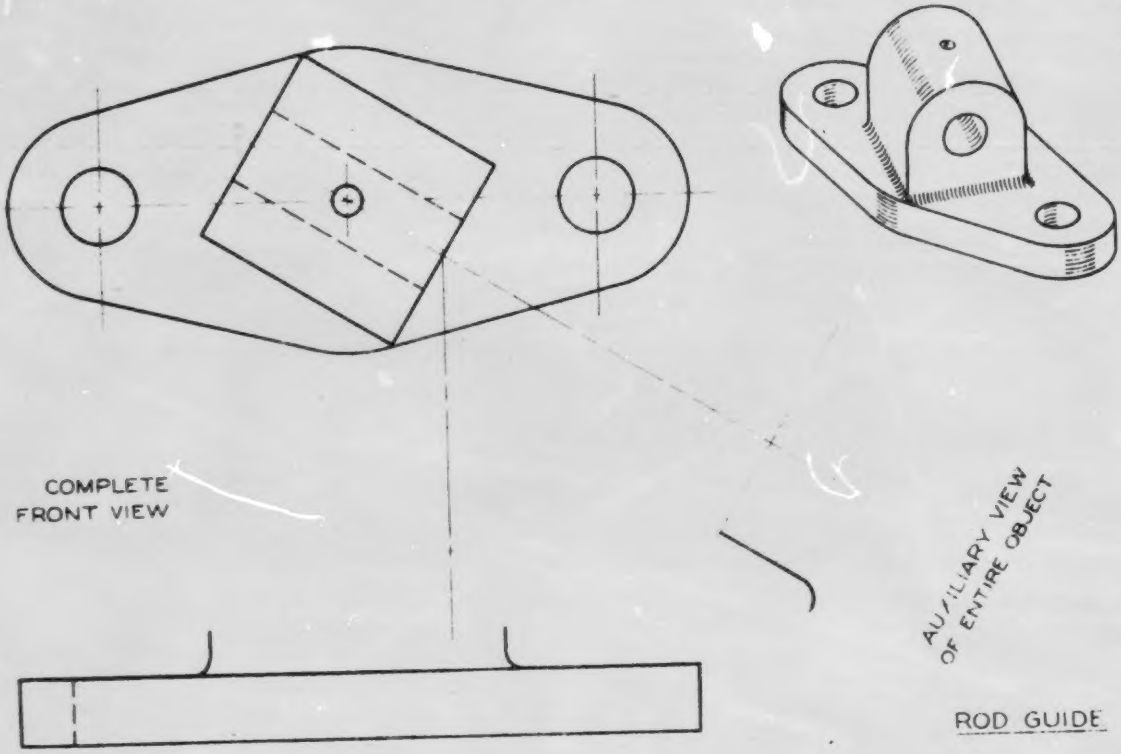
Basic Drafting Tools: (See Unit LEG)
Drafting Furniture: (See Unit LEG)

PROCEDURE:

1. Draw the auxiliary view of machined objects shown on the assignment sheet.
2. Have the instructor evaluate your drawings.
3. Proceed to LAP .04

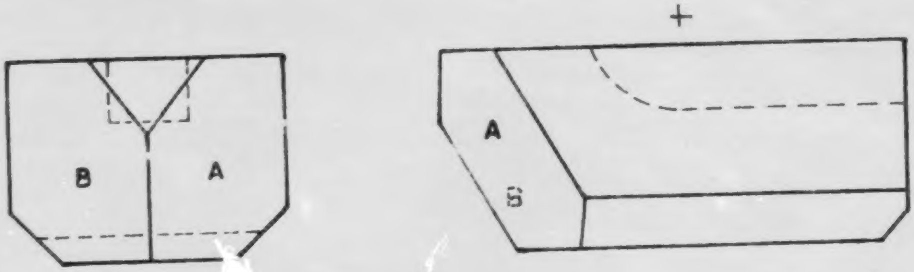
Principal Author(s): J. Wheatley, S. Vosen

①


COMPLETE
FRONT VIEW
AUXILIARY VIEW
OF ENTIRE OBJECT

ROD GUIDE

2



ALIGNMENT BLOCK

Draw the entire auxiliary view showing the true angle between A and B.

File Code: 79.01.09.02.A2-0

Date Published: 12-17-75
Revised: 1-16-80

Family Education Program

Learning Activity Package

Student: ____________________

Date: ____________________

PERFORMANCE ACTIVITY: Primary Auxiliary Views of Inclined Surfaced Objects

OBJECTIVE:

Draw the auxiliary view of various objects with inclined surfaces.

EVALUATION PROCEDURE:

Instructor will examine drawings for accuracy, neatness, line work and lettering. No errors will be allowed on this assignment.

RESOURCES:

Basic Technical Drawing, Chapter 12 -- 12.4, 12.6, 12.7, 12.9, 12.16.
Mechanical Drawing, Chapter 9 -- 9.7 - 9.10.
Technical Drawing, Chapter 8 -- 8.4 - 8.9, 8.11, 8.12.
Design Drafting, Chapter 10 -- 10.1 - 10.12.
Basic Drafting Tools: (See Unit LEG)
Drafting Furniture: (See Unit LEG)

PROCEDURE:

1. Read the above resource(s). Each of the above references describes auxiliary views by using different terminology and approaches. It is important for the draftperson to be able to read and use several different references.

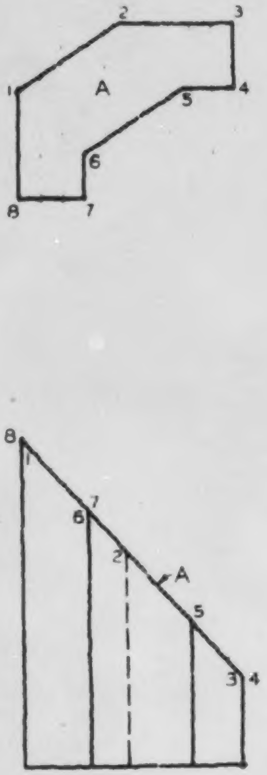
2. Draw the auxiliary view of objects shown on this assignment sheet.

   NOTE: Use the resource books as references to solve and complete the drawings. Each source contains information specifically related to the attached drawings. Choose the methods from the resources which you feel best relate to the drawings. Be as self-reliant as possible in making your decisions and drawing the objects.

3. Have your drawings evaluated by the instructor.

4. Take the combined LAP test after LAP .04.

Principal Author(s): J. Wheatley, S. Vosen


1
2
3
4
5
6
7
8
A
8
1
7
6
2
A
5
3
4

ANGLE CLIP

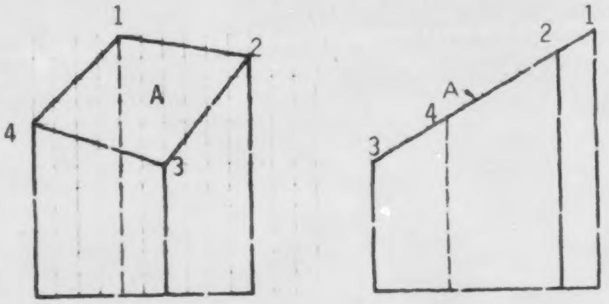
Draw auxiliary view of inclined surface A only.

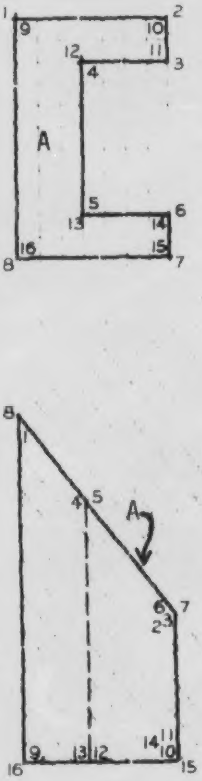
①

②

WEDGE

Draw auxiliary view of surface A only.

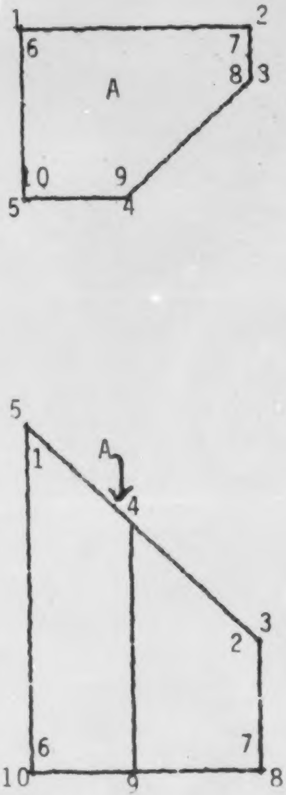

1
2
A
4
3
2
1
A
4
3


1
9
10
2
11
3
12
4
A
5
13
6
14
16
15
8
7
8
1
4
5
A
6
7
2
3
9
13
12
14
11
10
16
15

GUIDE BLOCK

Draw auxiliary view of entire object.

③


1
2
6
7
8
3
A
10
9
5
4
5
1
A
4
2
3
6
7
10
9
8

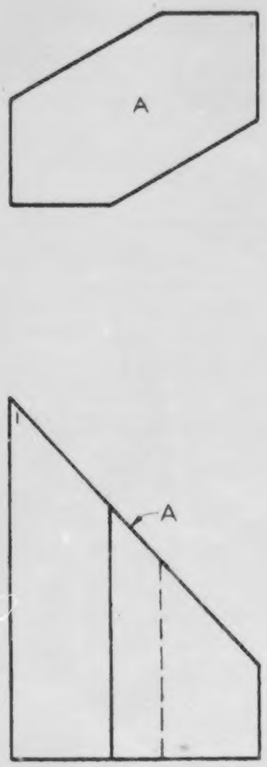
CONTROL STOP

Draw auxiliary view of entire object. showing surface a true size.

④

MOULDING

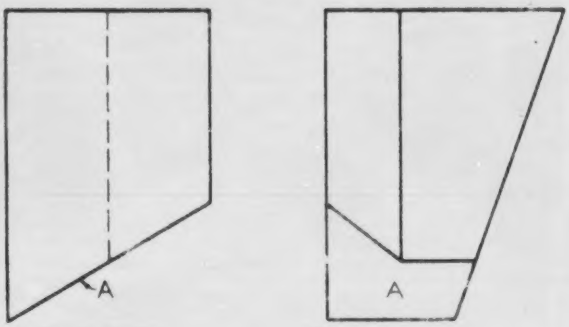
Draw auxiliary view of entire object showing true size of surface A.



⑤

ADJUSTABLE SLIDE

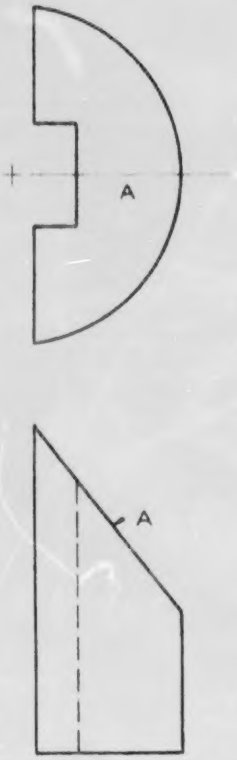
Draw auxiliary view of entire object showing true size of surface A



⑥

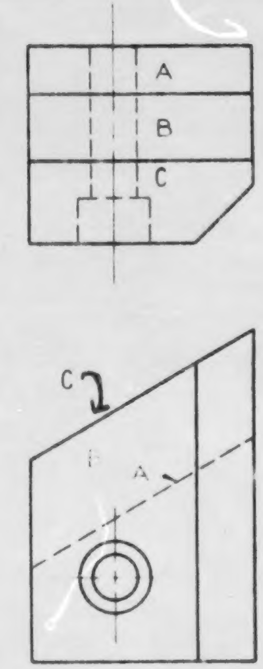
BEVELED SUPPORT

Draw auxiliary view of entire object showing true size of surface A.



⑦

Dimension required angle in degrees



GUIDE BLOCK Draw auxiliary view of entire object showing true angle between surfaces A and B.

⑧

Family Education Program

File Code: 79.01.09.01.A2-0

Date Published: 1-16-80

Learning Activity Package

Student: ______________________

Date: ______________________

PERFORMANCE ACTIVITY: Introduction to Auxiliary Views

OBJECTIVE:

To become familiar with auxiliary views; their uses, and terminology.

EVALUATION PROCEDURE:

Instructor will examine answers for correctness and understanding of concepts involved. No errors will be allowed on this assignment.

RESOURCES:

Basic Technical Drawing, Chapter 12.
Mechanical Drawing, Chapter 9 -- 9.5 - 9.11.
Technical Drawing, Chapter 8 -- 8.1 - 8.4, 8.20.
Design Drafting, Chapter 10 -- 10.1 - 10.12.

Basic Drafting Tools: (See Unit LEG)
Drafting Furniture; (See Unit LEG)

PROCEDURE:

1. Read the above resource(s).
2. Complete the following exercises and have your work evaluated by your instructor.
3. Letter definitions for the following terms:

   a. True length:

   b. True shape:

   c. Perpendicular:

   d. Parallel:

   e. Projection:

   f. Projectors:

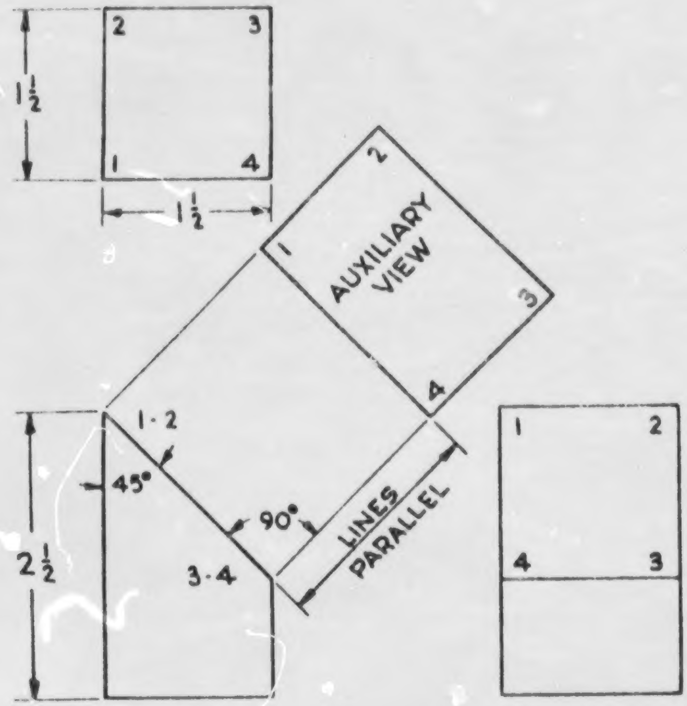
   g. L.O.S.:

   h. Reference line:

Principal Author(s): J. Wheatley

4. An auxiliary view is used to project an inclined surface (or angle) so that it is shown true shape and size.

Figure: .09-1



In Unit 4, you found that orthographic views of surfaces are true shape if the surface is parallel to the place of projection and the L.O.S. is perpendicular to the surface.

In orthographic projection, each view provides 2 of the true length dimensions, (height, width, and depth).

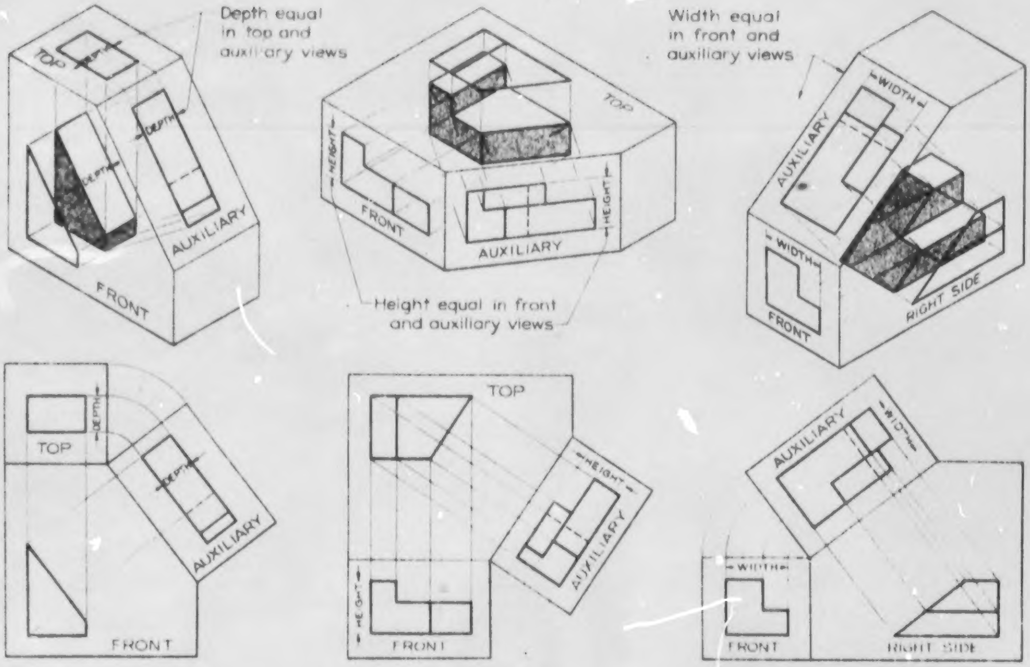
In auxiliary views, 2 true length dimensions are also drawn. One is projected perpendicular to the profile of the inclined surface, and the other is transferred from an orthographic view. A primary auxiliary may be either a depth auxiliary, width auxiliary, or a height auxiliary depending upon which dimension is transferred. (See Figure .09-2)

5. A step-by-step procedure using a reference line and projectors is shown on Figure 12-5 on page 215 in your "Basic Technical Drawing" text.

6. Draw in the reference line (R_O and R_A) and the projectors in Figure .09-4. Number the points.

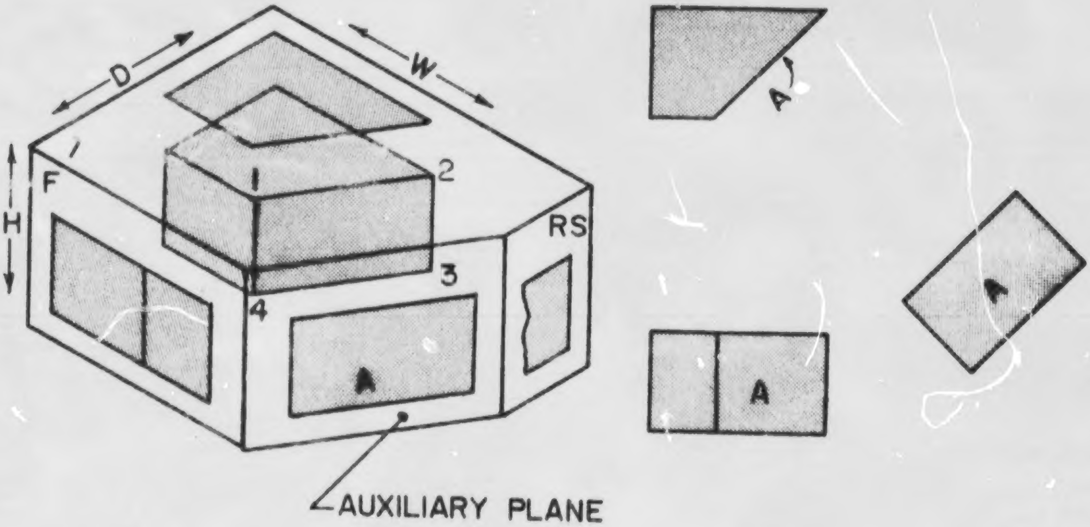
7. Upon completion of this LAP, take the LAP test and proceed to the next LAP.

Figure: .09-2


Depth equal in top and auxiliary views
TOP
DEPTH
AUXILIARY
FRONT
Height equal in front and auxiliary views
HEIGHT
Width equal in front and auxiliary views
WIDTH
RIGHT SIDE

(a) DEPTH AUXILIARY (b) HEIGHT AUXILIARY (c) WIDTH AUXILIARY

Figure: .09-4


D
W
H
F
1
2
3
4
RS
A
AUXILIARY PLANE

Student: ______________________ File Code: 79.01.09.00.B4-0

Date: ______________________ Date Published: 9-20-77

Revised: 1-16-80

Family Education Program

UNIT PERFORMANCE TEST: AUXILIARY VIEWS

OBJECTIVE 1:

Given an illustration of a machined object, the student will draw two auxiliary views of the object. The primary auxiliary view will contain all hidden lines necessary to project the secondary auxiliary view.

OBJECTIVE 2:

The student will be able to draw various auxiliary views that are neat and clean.

OBJECTIVE 3:

The student will be able to draw the three views having all lines accurate.

TASK:

The student will be given an illustration of a machined object. He/she will draw two auxiliary views and a right-end view of that object.

ASSIGNMENT:

Draw the "Slotted Guide" auxiliary views on the attached sheet.

CONDITIONS:

The drawing is to be completed in a typical drafting room setting, using lead on the attached sheet.

The student will not be able to use the instructor(s) or other students as a resource. Students may use text resources. You are encouraged to determine the text material which applies to this performance test, and to utilize that information is solving this drawing problem.

Student: ______________________ **File Code:** 79.01.09.00.B4-0

Date: ______________________ **Date Published:** ______________________

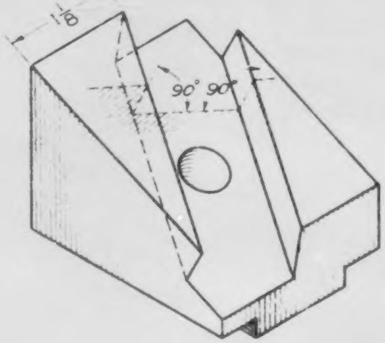
Family Education Program

PERFORMANCE CHECKLIST:

OVERALL PERFORMANCE: Satisfactory ____ Unsatisfactory ____

	CRITERION	
	Met	Not Met
Objective 1:		
1. Both auxiliary views are drawn.		
Criterion: All views drawn and no lines missing.		
2. All hidden lines are drawn in the primary view.		
Criterion: No points missing.		
Objective 2:		
3. Drawing is neat and clean.		
Criterion: (ASA Standard), Technical Drawing, pp. 12 and 22.		
Objective 3:		
4. All lines are accurate.		
Criterion: Lines are projected from given views and accurate		
within 1/64".		
5. The drawing is completed in the specified time limit.		
Criterion: Not to exceed 6 hours.		
Student must meet criterion on 4 out of 5 line items to obtain an over-		
all score of satisfactory.		

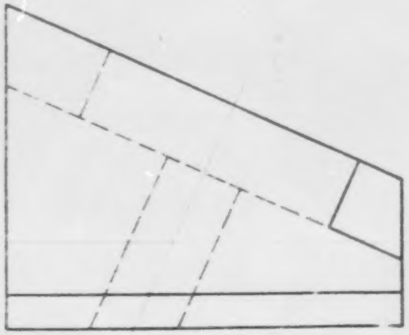
DRAWN BY:



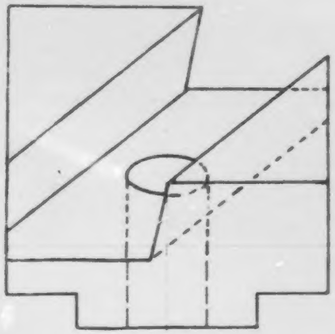
SLOTTED GUIDE

Draw complete primary auxiliary view, followed by complete secondary auxiliary view showing end of diagonal slot.

AUXILIARY VIEWS Performance Test 79.01.09.00



FRONT VIEW



BOTTOM OF DRAWING

Family Education Program

File Code: 79.01.09.00.B1-0

Date Published: 12-17-75

Date Revised: 1-15-80

Learning Experience Guide

UNIT: AUXILIARY VIEWS

RATIONALE:

When an object has inclined surfaces, the usual views cannot show the true size and shape of such surfaces. Therefore, it is necessary to draw a view on a plane parallel to the inclined surface. This view together with the regular views will show and describe the true size and shape of inclined or oblique surfaces.

PREREQUISISTES:

Unit 79.01.07. Section Views

OBJECTIVES:

Draw auxiliary views to supplement regular orthographic projections.

Identify auxiliary views for illustrated objects.

Identify the characteristics of auxiliary views that supplement regular orthographic projections.

RESOURCES:

Printed Materials

Basic Technical Drawing Spencer and Drydon; Macmillan Company, New York.
Mechanical Drawing French and Svenson; Webster Division, McGraw-Hill Book Company, New York.
Technical Drawing Sixth Edition; Gieseche, Mitchell, Spencer and Hill; Macmillan Company, New York.
Design Drafting Earle; Addison-Wesley Publishing, London.

Equipment

As listed in Course LEG.

Audio/Visual

Video Cassette for Unit 9.

Principal Author(s): J. Wheatley

GENERAL INSTRUCTIONS:

This unit consists of five Learning Activity Packages (LAPS). Each LAP will provide specific information for completion of a learning activity.

The general procedure for this unit is as follows:

1. Read the first assigned Learning Activity Package (LAP).
2. Begin and complete the first assigned LAP.
3. Keep the drawing mounted on the board until it has been checked and approved by the instructor.
4. Take the LAP test if indicated on LAP.
5. Proceed to and complete the next assigned LAP in the unit.
6. Complete all required LAPs for the unit by repeating steps 1 thru 5.
7. Take the unit tests as described in the Unit LEG "Evaluation Procedures".
8. Proceed to the next assigned unit.

PERFORMANCE ACTIVITIES:

.01 Introduction to Auxiliary Views.
.02 Primary Auxiliary Views of Inclined Surfaced Objects.
.03 Auxiliary Views of Machined Objects.
.04 Right Side, Auxiliary and Auxiliary Section Views.
.05 Primary and Secondary Auxiliary Views.

EVALUATION PROCEDURE:

1. The student takes a multiple-choice test and turns it in for correction.

2. The student takes a unit performance test. Successful unit completion is meeting the listed criteria for the performance test.

FOLLOW-THROUGH:

Auxiliary views will be drawn throughout the remainder of this course when they are required for clarity. They will apply specifically to Units 9, 13, and 14 -- Auxiliaries, Developments and Working Drawings.

Student: ______________________________ File Code: 79.01.09.00. A2-2 (.01-.04)
Date: ______________________________ Date Published: 6/21/74

Mountain-Plains Education &
Economic Development
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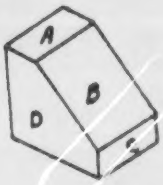
Glasgow AFB, Montana 59231

UNIT/LAP PRETEST: AUXILIARY VIEWS

1.

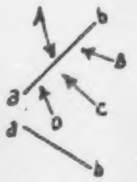


1. The plane that would project true shape in the front view is:
   - a. plane D.
   - b. plane A.
   - c. plane B.
   - d. plane C.

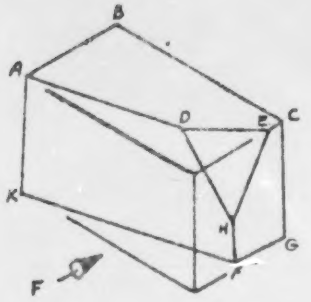
2. The plane that would project true shape in the right side view is:
   - a. plane B.
   - b. plane A.
   - c. plane C.
   - d. plane D.

3. The plane that would project true shape in the rear view is:
   - a. plane D.
   - b. plane A.
   - c. plane B.
   - d. plane C.

4. The top and front views of line ab are given below. The correct direction for the line of sight for an auxiliary view in which ab will appear true length is:
   - a. C.
   - b. B.
   - c. A
   - d. D.



5.



5. The **plane** DEH shown at the above will project true shape in:

    a. an auxiliary view.
    b. the top view.
    c. the right side view.
    d. the front view.

6. Line AD shown above will project true length in:

    a. an auxiliary view.
    b. the front view.
    c. the right side view.
    d. the top view.

7. Plane ABCED shown above will project true shape in:

    a. the front view.
    b. the top view.
    c. the right side view.
    d. an auxiliary view.

8. A projection on an auxiliary plane parallel to a slanting surface is:

    a. an auxiliary view.
    b. a section view.
    c. a projected slant view.
    d. a top view.

9. Features that appear distorted in regular views will appear true shape in:

   a. a top view.
   b. a section view.
   c. a folded view.
   d. an auxiliary view.

10. A view obtained by projection on any plane other than the horizontal, frontal, and profile projection planes is known as:

    a. a bottom view.
    b. a principal view.
    c. a regular view.
    d. an auxiliary view.

UNIT/LAP PRETEST ANSWER KEY: AUXILIARY VIEWS

1. D
2. C
3. A
4. A
5. A
6. D
7. B
8. A
9. D
10. D

Student: ______________________________ File Code: 79.01.09.00

Date: ______________________________ Date Published: 6-21-74

Revised: 12-05-78

Mountain-Plains Education &
Economic Development
Program, Inc.
Glasgow AFB, Montana 59231

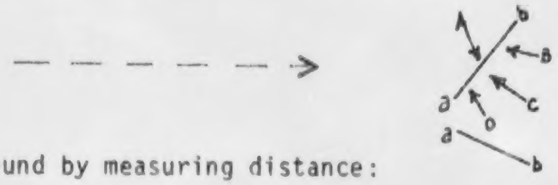
UNIT/LAP POST TEST: AUXILIARY VIEWS

1. To obtain an auxiliary view of a cylindrical object, the reference lines would be best placed:

   a. on the front edge of the auxiliary view.
   b. on the back edge of the auxiliary view.
   c. parallel to projection lines from the inclined surface.
   d. through the center of the symmetrical object.

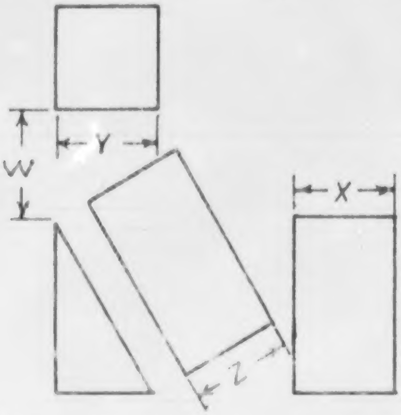
2. The top and front views of line "ab" are given below. The correct direction for the line of sight for an auxiliary view in which "ab" will appear true length is:

   a. C
   b. B
   c. A
   d. D



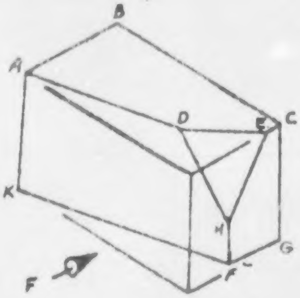
3. Dimension Z below is found by measuring distance:

   a. W
   b. X
   c. Y
   d. Y plus X



4. Plane ADHFK shown above will project true shape in:

   a. the top view.
   b. the front view.
   c. the right side view.
   d. an auxiliary view.



5. A dihedral angle is:

   a. the angle between two intersecting planes.
   b. the 90° angle formed by the projection lines extending from the edge of an inclined surface.
   c. a single line indicating where two separate planes intersect.
   d. obtained by assuming a direction of sight perpendicular to the line of intersection between two planes.

6. To get the edge view of a plane:

   a. assume a direction of sight which will allow you to see the shape of the plane.
   b. get the end point view of any line in that plane.
   c. assume a direction of sight perpendicular to the point view of a line in that plane.
   d. the most common practice is to revolve the object until the plane surface appears as a line.

7. It is possible to eliminate one or more regular views by the use of:

   a. an auxiliary view.
   b. a top view.
   c. a projected view.
   d. an end view.

8. A secondary auxiliary view is:

   a. a view which is not as important as other views.
   b. the second view drawn from the right side view.
   c. any auxiliary view projected from a primary auxiliary view.
   d. often used to show the edge view of an inclined surface.

9. Features that appear distorted in regular views will appear true shape in:

   a. a top view.
   b. a section view.
   c. a folded view.
   d. an auxiliary view.

10. A view obtained by projection on any plane other than the horizontal, frontal, and profile projection planes is known as:

    a. a bottom view.
    b. a principal view.
    c. a regular view.
    d. an auxiliary view.

UNIT/LAP POST TEST ANSWER KEY: AUXILIARY VIEWS

1. D
2. A
3. B
4. D
5. A
6. B
7. A
8. C
9. D
10. D

Student: ______________________ File Code: 79.01.09.01: A2-2

Date: ______________________ Date Published: 1-16-79

Family Education Program

LAP TEST: INTRODUCTION TO AUXILIARY VIEWS

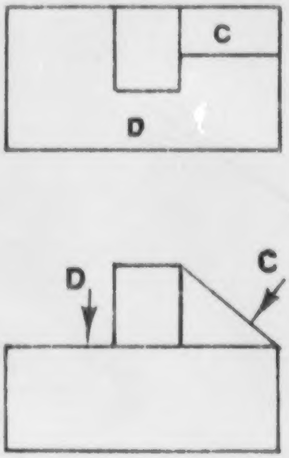
1. Auxiliary views are used to show the true size of a surface which:

   a. is parallel to one of the standard planes of projection.
   b. is perpendicular to the top, front or right side plane of projection.
   c. is at an angle other than 90° to the standard planes of projection.
   d. appears as a line in two of the standard planes of projection.

2. The position for one of the two required reference lines in Figure 1 is:

   a. at a 30° angle to the edge view of surface C.
   b. parallel to the projection lines extending from the edge view of surface C.
   c. perpendicular to the edge view of surface D.
   d. parallel to the edge view of surface C.

Fig. 1



3. A second reference line in Fig. 1, would be located:

   a. parallel to the edge view of surface D.
   b. perpendicular to projection lines between the two given views.
   c. at any angle projecting from the right side view.
   d. a second reference line is not needed.

4. Reference lines are:

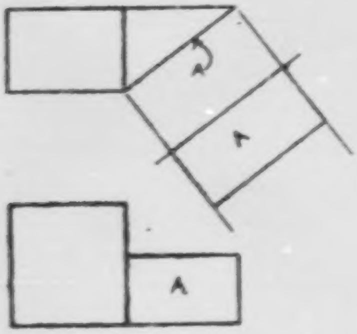
   a. primarily used to space the auxiliary view a sufficient distance away from the object.
   b. never used in orthographic projection.
   c. are the lines from which you measure when transferring a distance from one view to another.
   d. not to be drawn so that they cut through an object.

5. In drawing a depth auxiliary view, you will need:

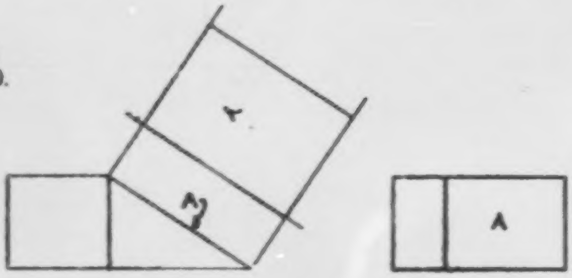
   a. three views of the object.
   b. the top and right side views.
   c. the front and rear views.
   d. the front view and one view showing depth.

6. Which of the following shows a width auxiliary view?

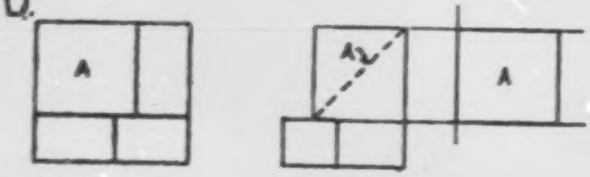
a



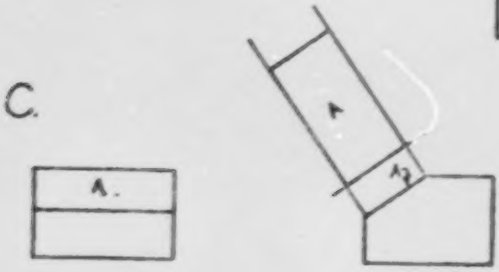
B.



D.



C.



7. When drawing an auxiliary view of an entire object which features an inclined surface:

   a. you will see thr true size and shape of each surface.
   b. you will see only those surfaces closest to you in their true size and shape.
   c. those surfaces which are not parallel to the reference line will be distorted in size and shape.
   d. measurements from all of the surfaces shown in this view would be accurate.

8. The views required to make a height auxiliary view are:

   a. top and front.
   b. front and right side.
   c. top, front and right side.
   d. front and left side.

9. Hidden lines in auxiliary views are:

   a. preferred to using an auxiliary section.
   b. never used.
   c. used in depth auxiliary views only.
   d. used for clarity of object shape.

10. Auxiliary views are:

   a. never used to replace a view of an object.
   b. often extra and unnecessary.
   c. often necessary for dimensioning.
   d. drawn to show the true shape of the entire top, front or right side view.

LAP TEST ANSWER KEY: INTRODUCTION TO AUXILIARY VIEWS

1. C
2. D
3. B
4. C
5. D
6. C
7. C
8. A
9. D
10. C

Family Education Program

File Code: 79.01.10.00:A2-1

Date Published: 2-8-79

Revised: 8-14-79

Learning Experience Guide

UNIT: TEMPLATES

RATIONALE:

Templates are used extensively in the drafting field. Templates are used to speed up drawing and make repetitive drawing easier. A knowledge of some of the many available templates is necessary to a draftsperson.

PREREQUISITES:

Unit 79.01.09 -- Auxiliary Views.

OBJECTIVES:

Students will become familiar with many of the templates available for the drafting areas. Students will learn to use templates quickly and efficiently. Line weight and neatness will meet ASA standards.

RESOURCES:

Printed Materials

Alvin catalog
Selby's catalog
Teledyne Post catalog
Dietrich Post catalog

Basic Technical Drawing. Spencer and Drydon, Macmillan Company, New York, 1968.
Engineering Drawing and Graphic Technology. French and Vierck, Eleventh Edition, McGraw-Hill Book Company, New York, 1973.
Mechanical Drawing. French and Svenson, Webster Division, McGraw-Hill Book Company, New York, 1968.
Technical Drawing. Gieseche, Mitchell, Spencer and Hill, Sixth Edition, Macmillan Company, New York, 1974.
Design Drafting. Earle, Addison-Wesley Publishing Company, Menlo Park, CA.

Equipment

As given in course LEG plus assorted templates.

Audio/Visuals

Video cassette for template useage.

Principal Author(s): J. Wheatley, S. Vosen

GENERAL INSTRUCTIONS:

This Unit consists of four LAPs. Each LAP will provide specific information for its completion.

The general procedure for this unit is:

1. Read the Unit LEG.
2. Proceed to the first LAP.
3. Complete the LAP.
4. Take the LAP test if indicated.
5. Repeat steps 2 thru 4.
6. Take the Performance Test.
7. Take the Unit Post Test.
8. Proceed to the next Unit.

PERFORMANCE ACTIVITIES (LAPs):

1. Introduction to Template Use
2. Using a Template to Draw an object.
3. Using a Template to Provide Plan and Elevation Views.
4. Using a Template to Draw Symbols.

EVALUATION PROCEDURE:

1. The student takes a multiple-choice unit post test and turns it in for evaluation.

2. The student takes a performance test. Successful unit completion is meeting the listed criteria for the performance test.

FOLLOW-THROUGH:

ASA Standards of neatness and line work will be observed throughout. Begin first LAP.

File Code: 79.01.10.01:A2-0

Date Published: 2-8-79

Family Education Program

Learning Activity Package

Student: ____________________

Date: ____________________

PERFORMANCE ACTIVITY: Introduction to Template Use

OBJECTIVE:

Student will become aware of the variety of templates available. Student will draw a classification chart.

EVALUATION PROCEDURE:

Instructor will examine classification chart to check that all information is included and line work and lettering is acceptable. There is no LAP test. Student will take Unit Post Test upon completion of all unit LAPs.

RESOURCES:

Technical Drawing. Page 715 -- Article 26-24.
Engineering Drawing and Graphic Technology. Page 433 -- Article 19
Page 726 -- Article 38

Mechanical Drawing. Page 390 -- Article 24-15.

Alvin Catalog

Drafting tools and equipment as listed in LEG.

PROCEDURE:

1. Read the resources listed.
2. Prepare a classification chart containing the following information.
    I. Drafting Aids
        A. Transfer materials
            1. pressure
            2. heat
            3. cut out films
            4. tapes
        B. Templates
            1. stencils
            2. burnishers
            3. guides (scribing)
            4. outline templates
                a) symbols
                b) shapes
                c) objects
                d) letters
3. The chart will be done in lead on a sheet of size "A" vellum.
4. Have the chart evaluated and then go on to the next LAP -- .02.

Principal Author(s): Vosen **Family Training Center Inc**

File Code: 79.01.10.02:A2-0

Family Education Program

Date Published: 2-8-79

Revised: 8-14-79

Learning Activity Package

Student: ______________________

Date: ______________________

PERFORMANCE ACTIVITY: Using a Template to Draw An Object

OBJECTIVE:

The student will draw several objects correctly using an outline template.

EVALUATION PROCEDURE:

The instructor will evaluate the drawings to see if they are drawn correctly and neatly. The drawing must be correct before the student proceeds to the next LAP. There is no LAP test.

RESOURCES:

Mechanical Drawing -- Unit 12.
Technical Drawing -- Unit 13.
Engineering Drawing and Graphic Technology -- Unit 15.
Design Drafting -- Unit 12.
Basic Technical Drawing -- Unit 14.

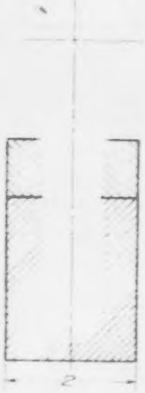
Drafting tools and equipment as listed in LEG.

PROCEDURE:

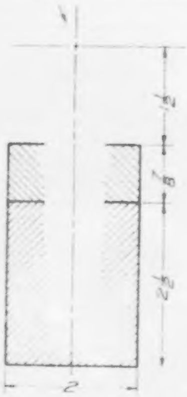
1. Read the resources listed.
2. Using the appropriate templates, draw the required fasteners. Use lead on a size "A" sheet of drawing paper.
3. Use schematic thread symbols on the first 2 drawings and simplified threaded symbols on the remaining ones.

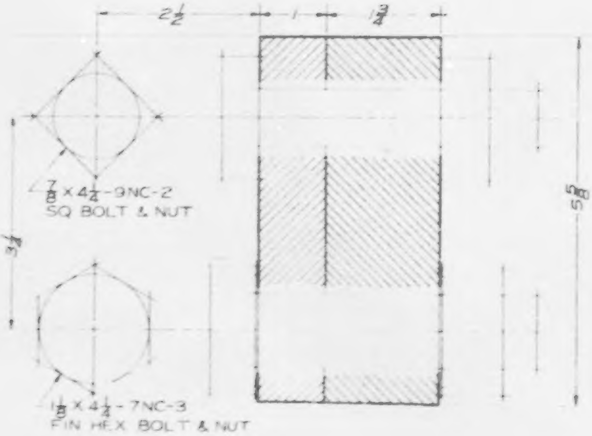
Principal Author(s): S. Vosen, J. Wheatley

9/16 x 2¼-24 UNF
FL HD Cap Screw



½ x 2 FILL HD
Machine Screw




2½
1
1¾
⅞ x 4¼ -9NC-2
SQ BOLT & NUT
3¼
5⅝
1⅛ x 4¼ - 7NC-3
FIN HEX BOLT & NUT

4. Have your drawing evaluated and proceed to the next LAP.

Family Education Program

File Code: 79.01.10.03:A2-0

Date Published: 2-8-79

Revised: 8-14-79

Learning Activity Package

Student: ____________________

Date: ____________________

PERFORMANCE ACTIVITY: Using a Template to Provide Plan and Elevation Views

OBJECTIVE:

The student will draw the required plan and elevation views using the appropriate template.

EVALUATION PROCEDURE:

The instructor will examine the views to see that they are accurate, correct, and neat. There is no LAP test.

RESOURCES:

Design Drafting, paragraph 19-30, page 535.

Drafting tools and equipment as listed in LEG.

PROCEDURE:

1. Read the resource listed.
2. Draw a plan and elevation view of the bathrooms shown in A and D. Each bathroom will be drawn on a size "A" sheet with lead.
3. Have the drawing evaluated and proceed to the next LAP.

HINT: Elevation views are generally shown from the door side of the room.

Principal Author(s): S. Vosen, J. Wheatley

Family Education Program

File Code: 79.01.10.04:A2-0

Date Published: 2-8-79

Revised: 8-14-79

Learning Activity Package

Student: ____________________

Date: ____________________

PERFORMANCE ACTIVITY: Using a Template to Draw Symbols

OBJECTIVE:

The student will draw the assigned schematics using the appropriate templates.

EVALUATION PROCEDURE:

The instructor will examine the drawings to insure that they are accurate and neat. There is no LAP test.

RESOURCES:

Mechanical Drawing -- Chapter 18.
Basic Technical Drawing -- Chapter 22.
Technical Drawing -- Chapter 21.
Engineering Drawing and Graphic Technology -- Chapter 20.

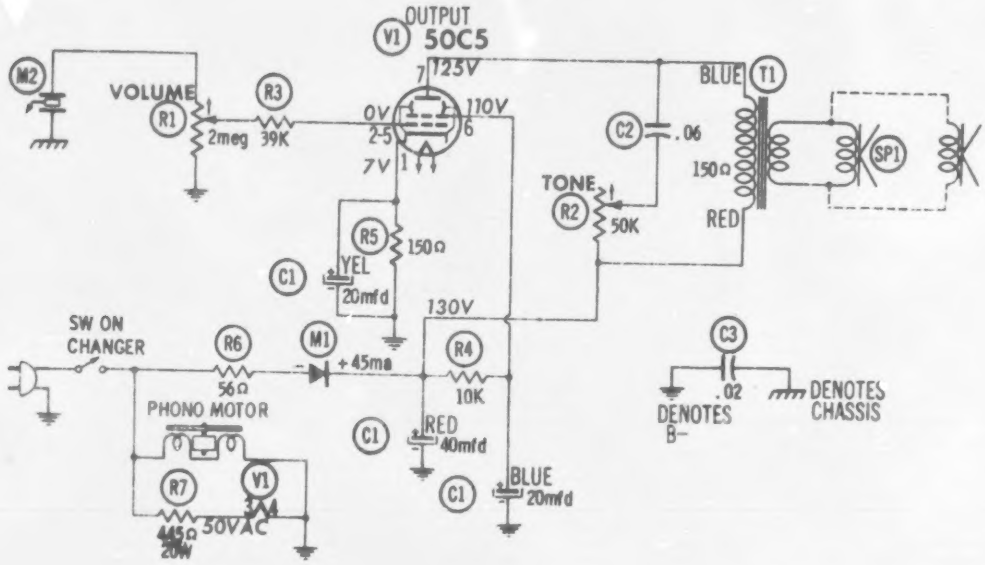
Drafting tools and equipment as listed in the LEG.

PROCEDURE:

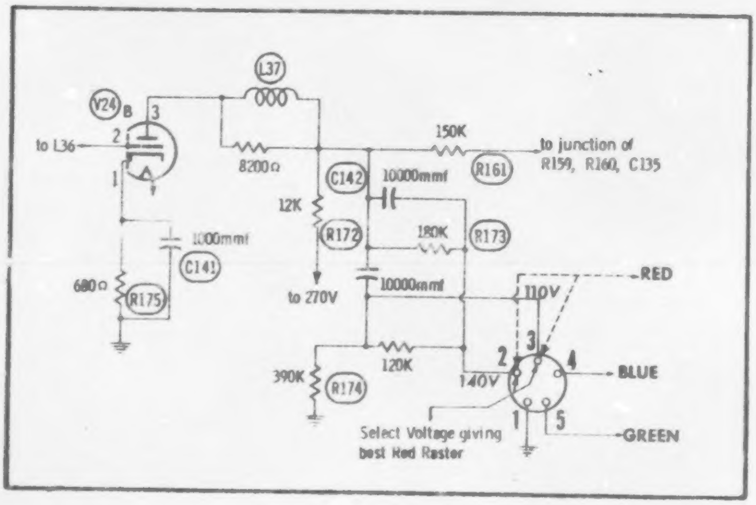
1. Read the resources listed.
2. Draw one of the circuit diagrams on the back of this page.
3. This diagram will be done in lead on a Size "A" vellum to twice scale.
4. Make a diazo print for the instructor's evaluation and proceed to the Performance Test.

Principal Author(s): S. Vosen, J. Wheatley

A.


V1
OUTPUT
50C5
M2
VOLUME
R1
2meg
R3
39K
0V
2-5
7
125V
110V
6
7V
1
BLUE
T1
C2
.06
150Ω
SP1
TONE
R2
50K
RED
R5
150Ω
C1
YEL
20mfd
130V
SW ON
CHANGER
R6
56Ω
M1
+45ma
R4
10K
PHONO MOTOR
C1
RED
40mfd
R7
V1
3A4
445Ω
20W
50VAC
C1
BLUE
20mfd
C3
.02
DENOTES
B–
DENOTES
CHASSIS

B.


L37
V24
B
3
2
to L36
1
8200Ω
150K
to junction of
R159, R160, C135
R161
C142
10000mmf
12K
R172
180K
R173
1000mmf
C141
680Ω
R175
to 270V
10000mmf
110V
RED
2
3
4
BLUE
120K
390K
R174
140V
1
5
GREEN
Select Voltage giving
best Red Raster

Student: ______________________ File Code: 79.01.10.00:B2-2

Date: ______________________ Date Published: 3-8-79

Family Education Program

UNIT PRE/POST TEST: TEMPLATES

1. In an actual drafting situation, templates are used:

   a. extensively
   b. occasionally
   c. rarely
   d. not at all

2. The main reason for template use is:

   a. accuracy
   b. laziness
   c. speed
   d. neatness

3. Templates are often used on:

   a. precision work
   b. repetitive work
   c. perspective drawings
   d. border lines

4. Cut-out templates can be used with:

   a. ink, lead and burnishers
   b. ruling pens, pencils and burnishers
   c. LeRoy pens, lead holders and ruling pens
   d. Pencils, lead holders and automatic reservoir pens

5. Templates can be used to draw:

   a. objects
   b. symbols
   c. diagrams
   d. all of these

UNIT PRE/POST TEST ANSWER KEY: TEMPLATES

1. A
2. C
3. B
4. D
5. D

File Code: 79.01.11.00.A2-1

Date Published: 12/17/75

Revised: 8-13-79

Mountain-Plains Education &
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Glasgow AFB, Montana 59231

Learning Experience Guide

UNIT: PICTORIAL DRAWINGS

RATIONALE:

The purpose of this unit is to study and use a system of drawing which enables the draftsman to show an object pictorially and in such a way that the principle lines can be measured directly. Pictorial views are used in technical illustrations. Patent office drawings, layouts, piping plans show detail which sometimes may not be clear in orthographic views.

PREREQUISITES:

Unit: 79.01.09 Auxiliary Views

OBJECTIVES:

Draw a pictorial drawing using five types of pictorial projections.

Identify the characteristics of the five types of pictorial projections.

RESOURCES:

Printed Materials

Basic Technical Drawing. Spencer & Drydon, Macmillan Company, New York.
Engineering Drawing and Graphic Technology. French & Vierck, Eleventh Edition, McGraw-Hill Book Company, New York.
Mechanical Drawing. French & Svenson, Webster Division, McGraw-Hill Book Company, New York.
Technical Drawing. Sixth Edition, Gieseche, Mitchell, Spencer & Hill, Macmillan Company, New York.
Design Drafting. James Earle, Addison-Wesley, California.

Equipment

Basic Drafting Tools: See Course LEG

Drafting Furniture: Stool, drafting
Table, drafting (with T-square, Parallel rule and/or drafting machine)

Audio/Visual

Video cassette on Unit 11.

Principal Author(s): C. Wetterling, J. Wheatley, S. Vosen

GENERAL INSTRUCTIONS:

This unit consists of five Learning Activity Packages (LAPs). Each LAP will provide specific information for completion of a learning activity.

The general procedure for this unit is as follows:

(1) Read the first assigned Learning Activity Package (LAP).
(2) Begin and complete the first assigned LAP.
(3) Take and score the LAP test.
(4) Turn in the LAP test answer sheet.
(5) Determine the reason for any missed items on the LAP test.
(6) Proceed to and complete the next assigned LAP in the unit.
(7) Complete all required LAPs for the unit by following steps 3 through 6.
(8) In this Unit, there are some LAPs that have tests combined with other LAP tests. These combined tests are taken after completing the last LAP covered by the test.
(9) Take the unit post test as described in the Unit LEG "Evaluation Procedures".
(10) Proceed to the next assigned unit.

PERFORMANCE ACTIVITIES:

.01 Isometric Drawings
.02 Cavalier Drawings
.03 Cabinet Drawings
.04 One-Point Perspectives
.05 Two-Point Perspectives

EVALUATION PROCEDURE:

When post testing:

1. The student takes a multiple-choice post test and turns it in for correction.

2. The student takes a unit performance test. Successful unit completion is meeting the listed criteria for the performance test.

FOLLOW-THROUGH:

Begin the first assigned Learning Activity Package (LAP) in this unit.

Student: ______________________ File Code: 79.01.11.00. A2-2

Date: ______________________ Date Published: 6/21/74

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Glasgow AFB, Montana 59231

UNIT PRETEST: PICTORIAL DRAWINGS

79.01.11.01.

1. The angle between the isometric axis is:

   a. 90 degrees.
   b. 120 degrees.
   c. 30 degrees.
   d. 45 degrees.

2. The type of line that is usually omitted from isometric drawing is:

   a. visible.
   b. hidden.
   c. center.
   d. circles and arcs.

3. Measuring of angles in isometric drawings is:

   a. not possible since angles do not show in their true size.
   b. done with the compass.
   c. done with the protractor.
   d. done with the triangles.

4. In an isometric drawing, circles will appear as:

   a. ellipses.
   b. parabolas.
   c. circles.
   d. hyperbolas.

5. The dimensioning method to use on an isometric drawing is:

   a. bottom.
   b. aligned.
   c. unidirectional.
   d. side.

79.01.11.02.
79.01.11.03.

6. In an oblique drawing, the number of principal views shown is:

   a. three.
   b. two.
   c. one.
   d. four.

7. A cabinet drawing is a type of:

   a. a oblique projection.
   b. axonometric projection.
   c. orthographic projection.
   d. perspective drawing.

8. When the projectors make a 45 degree angle with the plane of projection, the drawing is:

   a. an orthographic projection.
   b. a cavalier projection.
   c. a dimetric projection.
   d. a trimetric projection.

9. On an oblique drawing, the longest side of the object is placed:

   a. vertically.
   b. perpendicular to the plane of projection.
   c. parallel to the plane of projection.
   d. along the receding axis.

10. When measuring in an oblique drawing, the scale to use is:

   a. an ordinary scale.
   b. any of these.
   c. a metric scale.
   d. an engineers scale.

79.01.11.04.
79.01.11.05.

11. The representation of an object as it appears to the eye from a particular position is:

    a. an auxiliary view.
    b. an oblique drawing.
    c. a perspective drawing.
    d. an orthographic projection.

12. The position of the observer when looking at an object in perspective is called:

    a. the vanishing point.
    b. the picture plane.
    c. the projection point.
    d. the station point.

13. A one-point perspective is useful when drawing:

    a. orthographic projections.
    b. architectural exteriors.
    c. auxiliary views.
    d. architectural interiors.

14. The first step in drawing a perspective is to:

    a. draw the top view.
    b. draw the visual rays.
    c. draw the parallels.
    d. draw the phantom lines.

15. The type of dimensioning system used in perspectives is:

    a. unidirectional system.
    b. perspectives are usually not dimensioned.
    c. aligned system.
    d. bottom system.

UNIT PRETEST ANSWER KEY: PICTORIAL DRAWINGS

LAP		
01	1.	B
	2.	B
	3.	A
	4.	A
	5.	C
02- 03	6.	A
	7.	A
	8.	B
	9.	C
	10.	B
04- 05	11.	C
	12.	D
	13.	D
	14.	A
	15.	B

Family Education Program

File Code: 79.01.11.01.A2-0

Date Published: 12/18/75

Revised: 1-3-80

Learning Activity Package

Student: ____________________

Date: ____________________

PERFORMANCE ACTIVITY: Isometric Drawings

OBJECTIVE:

Draw an isometric working drawing of a machined object.

EVALUATION PROCEDURE:

Instructor will examine drawing for accuracy, neatness, line work, and lettering. No more than three errors will be allowed.

Correct answer at least 8 out of 10 items on a multiple-choice test that measures achievement of the objective for this LAP.

RESOURCES:

Design Drafting, Chapter 9 (Paragraphs 9-1 thru 9-18).

Basic Technical Drawing -- Chapter 16 (Paragraphs 16-1 thru 16-17).
Mechanical Drawing, pp. 193-202.
Engineering Drawing and Graphic Technology, Chapter 6 (Paragraphs 1 thru 15).

Basic Drafting Tools: (See Unit LEG)
Drafting Furniture: (See Unit LEG)

PROCEDURE:

1. Read the above resource book(s).
2. Draw an isometric working drawing from one of the following drawings: "Basic Technical Drawing" (Pg. 122, Drawing 7-31-4) (Pg. 125, Drawing 7-46) (Pg. 125, Drawing 7-48) or (Pg. 126, Drawing 7-52).

   NOTE: Use the problem that you have selected for this LAP throughout the remainder of the drawings for this unit.

   The drawing will be done in pencil on a 9 X 12 sheet of drawing paper!
3. Have the instructor evaluate your drawing.
4. Take and score the LAP test.
5. Proceed to the next LAP.

Principal Author(s): C. Wetterling, J. Wheatley, S. Vosen

Student: ______________________ File Code: 79.01.11.01. A2-2

Date: ______________________ Date Published: 6/21/74

Mountain-Plains Education &
Economic Development
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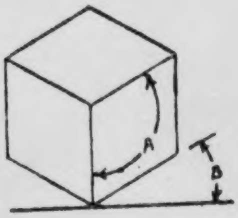
Glasgow AFB, Montana 59231

LAP TEST: ISOMETRIC DRAWINGS



1. In an isometric drawing, angle A shown above is:

   a. 100 degrees.
   b. 115 degrees.
   c. 30 degrees.
   d. 120 degrees.

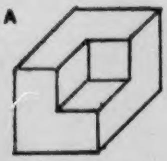
2. In an isometric drawing, angle B shown above is:

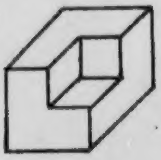
   a. 60 degrees.
   b. 25 degrees.
   c. 20 degrees.
   d. 30 degrees.

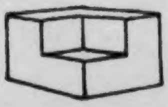
3. In an isometric drawing, the number of principal views shown is:

   a. four.
   b. two.
   c. one.
   d. three.

4. An isometric drawing of the object shown in Figure A should look like:

A


C


B


D any of these.

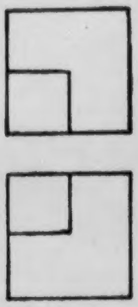


Figure A

5. Measurements on an isometric drawing should be made:

   a. vertical or horizontal.
   b. with a metric scale.
   c. parallel to the isometric axis.
   d. so they are reduced by four-fifths.

6. An example of a pictorial drawing is:

   a. section.
   b. isometric.
   c. auxiliary.
   d. orthographic.

7. The type of line that is usually omitted from isometric drawing is:

   a. visible.
   b. hidden.
   c. center.
   d. circles and arcs.

8. In an isometric drawing, circles will appear as:

   a. ellipses.
   b. parabolas.
   c. circles.
   d. hyperbolas.

9. The first step in making an isometric drawing is:

   a. lay out the top view.
   b. draw the isometric axis.
   c. determine the spacing between the three views.
   d. draw the circles and arcs.

10. The dimensioning method to use on an isometric drawing is:

   a. bottom.
   b. aligned.
   c. unidirectional.
   d. side.

LAP TEST ANSWER KEY: ISOMETRIC DRAWINGS

1. D
2. D
3. D
4. B
5. C
6. B
7. B
8. A
9. B
10. C

Family Education Program

File Code: 79.01.11.02.A2-0
Date Published: 11/06/74
Revised: 08/08/78

Learning Activity Package

Student: ________________
Date: ________________

PERFORMANCE ACTIVITY: Oblique Drawings: Cavalier

OBJECTIVE:

Draw a cavalier working drawing of a machined object.

EVALUATION PROCEDURE:

Instructor will examine drawing for accuracy, neatness, linework, and lettering. No more than three errors will be allowed.

RESOURCES:

Basic Technical Drawing, Chapter 16 (Paragraphs 16-18 thru 16-27).
Design Drafting, Chapter 9 (Paragraphs 9-19 thru 9-27).
Engineering Drawing and Graphic Technology, Chapter 6 (Paragraphs 18 thru 23).

PROCEDURE:

1. Read the pages from the above resource book(s).
2. Draw a cavalier working drawing of your assigned problem from LAP 01. Draw the receding axis at 45°. Use a 9 X 12 sheet and lead.
3. Turn in your drawings to the instructor for evaluation.
4. Complete LAP 03 before taking LAP Test.
5. Proceed to the next LAP.

Principal Author(s): C. Wetterling, J. Wheatley, S. Vosen

Family Education Program

Learning Activity Package

File Code: 79.01.11.03.A2-2

Date Published: 11/06/74

Revised: 08/08/78

Student: ________________

Date: ________________

PERFORMANCE ACTIVITY: Oblique Drawings: Cabinet

OBJECTIVE:

Draw a cabinet working drawing of a machined object.

EVALUATION PROCEDURE:

Instructor will examine drawing for accuracy, neatness, linework, and lettering. No more than three errors will be allowed.

RESOURCES:

Basic Technical Drawing, Chapter 16 (Paragraphs 16-18 thru 16-27).
Design Drafting, Chapter 9 (Paragraphs 9-19 thru 9-27).
Engineering Drawing and Graphic Technology, Chapter 6 (Paragraphs 24 & 25).

PROCEDURE:

1. Read the pages from the above resource book(s).
2. Draw a cabinet working drawing of your assigned problem from LAPs 01 & 02 Draw the receding axis at 45°. Use a 9 X 12 sheet and lead.
3. Turn in your drawings to the instructor for evaluation.
4. Take the LAP Test for LAPs 02 and 03.
5. Proceed to the next LAP.

Principal Author(s): C. Wetterling, J. Wheatley, S. Vosen

Student: ______________________ File Code: 79.01.11.02. A2-2
79.01.11.03. A2-2

Date: ______________________ Date Published: 6/21/74

Mountain-Plains Education &
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LAP TEST: CAVALIER DRAWINGS/CABINET DRAWINGS

1. The receding axis in an oblique drawing is drawn at:

   a. an angle of 120 degrees to the other axis.
   b. 90 degrees to horizontal.
   c. 90 degrees to vertical.
   d. any angle between 15 degrees and 75 degrees.

2. In an oblique drawing, the number of principal views shown is:

   a. three.
   b. two.
   c. one.
   d. four.

3. A cavalier is a type of:

   a. oblique projection.
   b. axonometric projection.
   c. orthographic projection.
   d. perspective drawing.

4. A cabinet drawing is a type of:

   a. oblique projection.
   b. axonometric projection.
   c. orthographic projection.
   d. perspective drawing.

5. In oblique projection, the angle that the projectors make with the plane of projection is always:

   a. an oblique angle.
   b. parallel.
   c. perpendicular.
   d. 120 degrees.

6. When the projectors make a 45 degree angle with the plane of projection, the drawing is:

   a. an orthographic projection.
   b. a cavalier projection.
   c. a dimetric projection.
   d. a trimetric projection.

7. When the receding lines are drawn to half size, the drawing is:

   a. a cabinet projection.
   b. a cavalier projection.
   c. an orthographic projection.
   d. a half-scale projection.

8. On an oblique drawing, the object is positioned so most of the arcs appear in:

   a. the top plane.
   b. the front plane.
   c. the left plane.
   d. the right plane.

9. On an oblique drawing, the longest side of the object is placed:

   a. vertically.
   b. perpendicular to the plane of projection.
   c. parallel to the plane of projection.
   d. along the receding axis.

10. When measuring in an oblique drawing, the scale to use is:

    a. an ordinary scale.
    b. any of these.
    c. a metric scale.
    d. an engineers scale.

LAP TEST ANSWER KEY: CAVALIER DRAWINGS/CABINET DRAWINGS

1. D
2. A
3. A
4. A
5. A
6. B
7. A
8. B
9. C
10. B

Family Education Program

File Code: 79.01.11.04.A2-0

Date Published: 12/18/75

Revised: 8-13-79

Learning Activity Package

Student: ______________________

Date: ______________________

PERFORMANCE ACTIVITY: One-Point Perspectives: Orthographic Method

OBJECTIVE:

Draw a one-point perspective of a machined object using the orthographic method.

EVALUATION PROCEDURE:

Instructor will examine drawing for accuracy, neatness, linework, and lettering. No more than three errors will be allowed.

Successful completion of this LAP is determined by correctly answering at least 8 out of 10 items on a multiple-choice test that is combined with "Two-Point Perspectives" LAP test and is taken after completing that LAP.

RESOURCES:

Design Drafting, Chapter 18.
Basic Technical Drawing, Para. 16-28 & 29, pp. 321 & 322. Paragraph 16.32, Pg. 325 & 326.
Mechanical Drawing, pp. 208-210.
Engineering Drawing and Graphic Technology, Chapter 6 (Paragraphs 29 thru 34).

Basic Drafting Tools: (See Unit LEG)
Drafting Furniture: (See Unit LEG)

PROCEDURE:

1. Read the above resource(s).

2. Draw a one-point perspective of the drawing from LAPs 01, 02, & 03. Use pencil and a 12 X 18 sheet.

   NOTE: Do not move or remove the completed drawing from your board.
   NOTE: You will need 2 orthographic views showing width, height, and depth.

3. Have the instructor evaluate your drawing.

4. Wait until completing LAP 05 to take LAP Test.

5. Proceed to LAP 05.

Principal Author(s): C. Wetterling, J. Wheatley, S. Vosen

Family Education Program

File Code: 79.01.11.05.A2-0

Date Published: 12/18/75

Revised: 8-13-79

Learning Activity Package

Student: ____________

Date: ____________

PERFORMANCE ACTIVITY: Two-Point Perspectives: Orthographic Method

OBJECTIVE:

Draw a two-point perspective of a machined object using the orthographic method.

EVALUATION PROCEDURE:

Instructor will examine the drawing for accuracy, neatness, linework, and lettering. No more than three errors will be allowed.

Successfully complete at least 8 out of 10 items on a multiple-choice test.

RESOURCES:

Design Drafting, Chapter 18.
Basic Technical Drawing, Chapter 16 (Paragraphs 16-30 & 16-31).
Mechanical Drawing, pp. 211-217.
Engineering Drawing and Graphic Technology, Chapter 6 (Paragraphs 29 thru 34).

Basic Drafting Tools: (See Unit LEG)
Drafting Furniture: (See Unit LEG)

PROCEDURE:

1. Read the resource(s).
2. Draw a two-point perspective of the drawing from previous LAPs. Use pencil and a 12 X 18 sheet.

   NOTE: Do not move or remove your completed drawing from your board.
   NOTE: You will need 2 orthographic views showing width, height, and depth.
3. Have the instructor evaluate your drawing.
4. Take the LAP test.
5. Proceed to Performance Test.

Principal Author(s): C. Wetterling, J. Wheatley, S. Vosen

Student: ______________________ File Code: 79.01.11.04.A2-2
79.01.11.05.A2-2

Date: ______________________ Date Published: 8/13/75

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LAP TEST: ONE-POINT AND TWO-POINT PERSPECTIVES

1. The representation of an object as it appears to the eye from a particular position is:

   a. an auxiliary view.
   b. an oblique drawing.
   c. a perspective drawing.
   d. an orthographic projection.

2. The plane upon which a perspective view is drawn is called:

   a. the perspective plane.
   b. the projection plane.
   c. the picture plane.
   d. the orthographic plane.

3. A one-point perspective is useful when drawing:

   a. orthographic projections.
   b. architectural exterior.
   c. auxiliary views.
   d. architectural interiors.

4. The first step in drawing a perspective is to:

   a. draw the top view.
   b. draw the visual rays.
   c. draw the parallels.
   d. draw the phantom lines.

5. The type of dimensioning system used in perspectives is:

   a. unidirectional system.
   b. perspectives are usually not dimensioned.
   c. aligned system.
   d. bottom system.

LAP TEST ANSWER KEY: ONE-POINT AND TWO-POINT PERSPECTIVES

1. C
2. C
3. D
4. A
5. B

Student: ____________________ File Code: 79.01.11.00.A1-5

Date: ____________________ Date Published: 11/06/74

Revised: 08/08/78

Mountain-Plains Education &
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UNIT PERFORMANCE TEST: PICTORIAL DRAWINGS

OBJECTIVE 1:

Given a machined object, the student will be able to assemble the five types of projections into a balanced pictorial representation.

OBJECTIVE 2:

The student will be able to draw this pictorial representation in ink on the plastic film.

OBJECTIVE 3:

The student will be able to trace the representation accurately and properly.

OBJECTIVE 4:

The student will be able to reproduce this drawing by the Diazo process.

TASK:

The student will make a finished drawing and Diazo print of the five types of projections.

ASSIGNMENT:

Draw the objects used in LAPs one through five in ink on a 12 X 18 sheet of Mylar and label it correctly. Make a Diazo print of the drawing.

CONDITIONS:

The drawing is to be completed in the drafting room, using the necessary facilities. The resources are as listed in the Unit LEG. The instructor, or other students, may not be used as resources.

Student: ______________________ **File Code:** 79.01.11.00:A1-5

Date: ______________________ **Date Published:** 11-6-74

Revised: 8-17-79

Family Education Program

PERFORMANCE CHECKLIST:

OVERALL PERFORMANCE: Satisfactory _____ Unsatisfactory _____

	CRITERION	
	Met	Not Met
Objective 1:		
1. All five types of projections are shown in their entirety.		
Criterion: No lines missing.		
Objective 2:		
2. The drawing is inked properly and is clean and neat.		
Criterion: (ASA Standards), Technical Drawing, pp. 12, 20, 22.		
Objective 3:		
3. All line work is accurate.		
Criterion: All line measurements within 1/64" of scale.		
Objective 4:		
4. The Diazo Print will be legible.		
Criterion: The drawing will reproduce evenly and background will be white.		
5. The drawing will be completed in a specified time limit.		
Criterion: Not to exceed 6 hours.		
The student must meet 4 out of 5 to satisfactorily complete.		

Student: ______________________ File Code: 79.01.11.00. B2-2

Date: ______________________ Date Published: 6/21/74

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UNIT POST TEST PICTORIAL DRAWINGS

79.01.11.01.

1. When measuring in an isometric drawing, the proper scale to use is:

   a. an isometric scale.
   b. a metric scale.
   c. an ordinary scale.
   d. any of these.

2. The only type of object that can be drawn in isometric is:

   a. an object without arcs.
   b. a rectangular prism.
   c. an object that is machined.
   d. any type of object.

3. The angle between the isometric axis is:

   a, 90 degrees.
   b. 120 degrees.
   c. 30 degrees.
   d. 45 degrees.

4. The tools that are used to draw isometrics are:

   a. T-square and 45 degree triangle.
   b. T-square and 30 degree x 60 degree triangle.
   c T-square and proportional dividers.
   d. T-square and protractor.

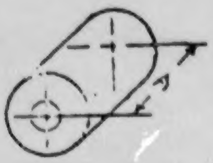
5. Measuring of angles in isometric drawings is:

   a. not possible since angles do not show in their true size.
   b. done with the compass.
   c. done with the protractor.
   d. done with the triangle.

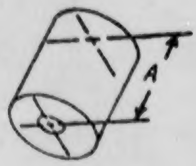
79.01.11.02.
79.01.11.03.

6. A cavalier drawing of the object shown in Figure B should look like:

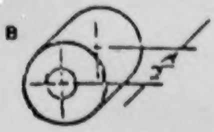
C



A



B



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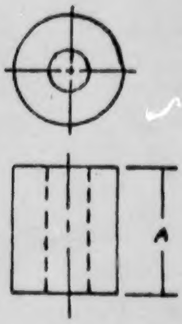
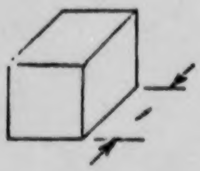


Figure B

7. A cabinet drawing of a cube should look like:

A



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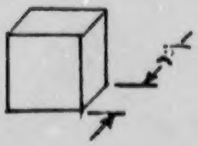

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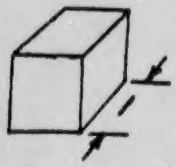

8. Circles and arcs in oblique appear true-size true-shape in:

a. the front plane.
b. the left plane.
c. the right plane.
d. the top plane.

9. A cabinet drawing is a type of:

a. oblique projection.
b. axonometric projection.
c. orthographic projection.
d. perspective drawing.

79.01.11.02.
79.01.11.03.

10. The first step in making an oblique drawing is:

a. determine the spacing between the three views.
b. lay out the top view.
c. lay out the front view.
d. draw the oblique axis.

79.01.11.04.
79.01.11.05.

11. The representation of an object as it appears to the eye from a particular position is:

a. an auxiliary view.
b. an oblique drawing.
c. a perspective drawing.
d. an orthographic projection.

12. The projectors for a perspective view are called:

a. phantom lines.
b. parallels.
c. visiual rays.
d. center lines.

13. The plane upon which a perspective view is drawn is called:

a. the perspective plane.
b. the projection plane.
c. the picture plane.
d. the orthographic plane.

14. The position of the observer when looking at an object in perspective is called:

a. the vanishing point.
b. the picture plane.
c. the projection point.
d. the station point.

79.01.11.04.
79.01.11.05.

15. The first step in drawing a perspective is to:

  - a. draw the top view.
  - b. draw the visual rays.
  - c. draw the parallels.
  - d. draw the phantom lines.

79.01.11.00.B2-2
Revised: 12-03-79

UNIT POST TEST ANSWER KEY: PICTORIAL DRAWINGS

LAP		
01	1.	D
	2.	D
	3.	B
	4.	B
	5.	A
02- 03	6.	C
	7.	B
	8.	A
	9.	A
	10.	C
04- 05	11.	C
	12.	C
	13.	C
	14.	D
	15.	A

File Code: 79.01.12.00

Date Published: 1/20/78

Revised: 11/26/79

Mountain-Plains Education &
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Glasgow AFB, Montana 59231

Learning Experience Guide

COURSE: MAPPING

RATIONALE:

The use and conservation of land has become important year after year. The importance of mapping is emphasized since it is a means to represent portions of the earth's surface and it's natural features. The purpose of this unit is to study and use the basic systems of mapping. These systems include the plat plan, grid work, contours, and profiles. Each drawing will be completed in the proper manner to the proper scale. Mapping is used in many job areas. Civil engineering, mining, construction, planning, and etc.

PREREQUISITES:

Previous units.

OBJECTIVES:

The student will demonstrate skill in the fundamentals of basic mapping: Plat plans, contour maps, and profiles; and knowledge in their related terminology and symbols. From a given survey plat draw a plat plan, grid squares, contours, and a profile to scale.

RESOURCES:

Manual of Surveying Instructions; 1973 - Bureau of Land Management, Department of Interior.
Basic Technical Drawing, Spencer & Drydon, Macmillan Company, New York.
Engineering Drawing and Graphic Technology, French & Vierck, Eleventh Edition, McGraw-Hill Book Company, New York.
Mechanical Drawing, French & Svenson, Webster Division, McGraw-Hill Book Company, New York.
Technical Drawing, Sixth Edition, Gieseche, Mitchell, Spencer & Hill, Macmillan Company, New York.

EQUIPMENT:

Basic Drafting tools as set forth in Resource Course LEG 79.01.00.00.
Drafting Furniture: Stool, Drafting
Table, Drafting (with T-square, parallel rule, and/or Drafting machine)

GENERAL INSTRUCTIONS:

This unit consists of four Learning Activity Packages (LAP's). Each LAP will provide specific information for completion of a learning activity.

Principal Author(s): C. Wetterling, C. Lynch

The general procedure for this unit is as follows:

1. Read the first assigned Learning Activity Package (LAP).
2. Begin and complete the first assigned LAP.
3. Proceed to and complete the next assigned LAP in the unit.
4. Complete all required LAP's for the unit by following steps 1 through 3.
5. Take the unit post test as described in the unit LEG "Evaluation Procedures".
6. Proceed to the next assigned unit.

PERFORMANCE ACTIVITIES:

.01 Plat Plans
.02 Grids
.03 Contours
.04 Profiles

EVALUATION PROCEDURES:

When post testing:

1. The student takes a multiple-choice post test and turns it in for correction.
2. The student takes a unit performance test. Successful unit completion is meeting the listed criteria for the performance test.

FOLLOW-THROUGH:

Begin the first assigned Learning Activity Package (LAP) in this unit.

Student: ____________________ **File Code:** 79.01.12.00

Date: ____________________ **Date Published:** 7-27-78

Revised: 12-03-79

Family Education Program

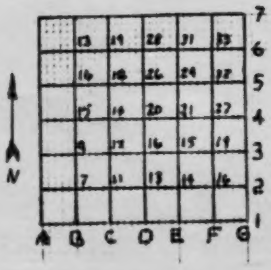
UNIT POST TEST: MAPPING

1. In mapping, the term "plat" refers to:

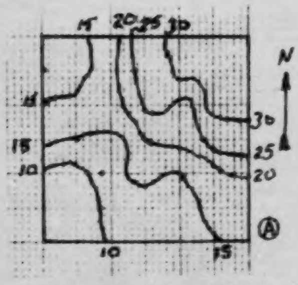
   a. the science of map making.
   b. a chart showing a highway.
   c. a small map plotted from a land survey.
   d. the bearing of a line.

2. Given the following grid, what is the elevation of point C-4.

   a. 18
   b. 14
   c. 13
   d. not given


N
A B C D E F G
1 2 3 4 5 6 7

3. Using the grid, which contour map is correct?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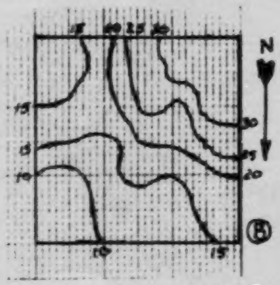
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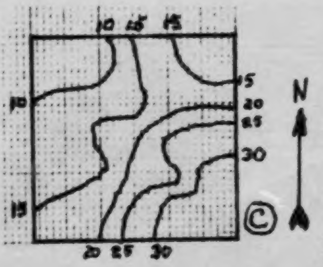
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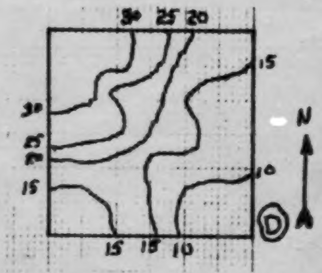
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25
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15
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N
15 15 10
D

4. The contour line is a line of points which:

   a. are in a straight horizontal line.
   b. are in a straight vertical line.
   c. are random points on a curved line.
   d. are the same elevation.

5. Given the traverse N30° 15'E from a point which traverse below would be the same line:

   a. N59° 45'E
   b. S30° 15'W
   c. S30° 15'E
   d. S59° 45'W

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6. The profile view of a map is similar to:

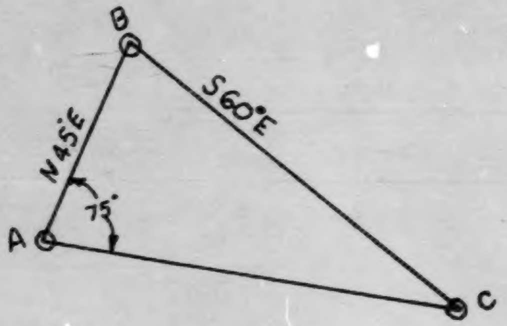
   a. a section view of a machined object.
   b. an auxillary view of a machined object.
   c. a development of a hollow object.
   d. a pictoral view of an object.

7. Every contour line will:

   a. touch another contour line
   b. run from one end of the map to the other.
   c. close on itself if extended far enough.
   d. will cross another contour line.

8. Given the following two traverses, what is the direction from point C of the third traverse:

   a. N^{0} 75W
   b. S75^{0} E
   c. N60^{0} E
   d. N60^{0} W



9. There are how many minutes in 4^{0}35'?

   a. 435 minutes
   b. 275 minutes
   c. 39 minutes
   d. 235 minutes

10. In mapping, what does the following symbol stand for? sta 931 ⊗

   a. a reference point for measuring.
   b. a field transit symbol.
   c. a closed traverse.
   d. a cartography profile.

UNIT POST TEST ANSWER KEY: MAPPING

1. C
2. B
3. A
4. D
5. B
6. A
7. C
8. D
9. B
10. A

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File Code: 79.01.12.01

Date Published: 1/20/78
Revised: 11/26/79

Learning Activity Package

Student:

Date:

PERFORMANCE ACTIVITY: PLAT PLANS

OBJECTIVE:

Given locations, bearings, and distances, the student will accurately and correctly draw a plat plan to the correct scale. Identify the purpose, symbols, and related terminology of plat plans.

EVALUATION PROCEDURE:

The instructor will check the plat for accuracy, neatness, and correctness. A multiple choice unit test will be used to check the student's understanding of purpose, symbols, and related terminology of plat plans.

RESOURCES:

Basic Drafting Furniture
Basic Drafting Instruments
Drafting Arm or Machine
Technical Drawing, Chapter 23
Basic Technical Drawing, Chapter 21
Manual of Surveying Instructions; 1973 -- Chapter 9.

PROCEDURE:

1. Read the above resources, book(s).
2. Obtain a sheet of 18" x 24" drawing paper.
3. Have the instructor assign true north on your paper.
4. Make a drawing of the land survey plat plan, Page 396 of Basic Technical Drawing, of 1"=400'.
5. Have the instructor check your drawing for accuracy.
6. When the drawing has been approved by the instructor, trace the completed map on Mylar. LeRoy all lettering and numbering. Ink the border and title block. Use the suggested lettering size shown on page 200 of M.S.I.
7. Make a blueprint copy of the finished drawing and submit it to the instructor for checking.

Note: This LAP uses three skills you have already acquired -- drawing requires angles, lengths and scaling.

Principal Author(s): C. Lynch, C. Wetterling

Mountain-Plains Education &
Economic Development
Program, Inc.
Glasgow AFB, Montana 59231

File Code: 79.01.12.02:A2-0

Date Published: 5-4-77

Revised: 1-12-79

Learning Activity Package

Student: ____________

Date: ____________

PERFORMANCE ACTIVITY: Survey Grids

OBJECTIVE:

Given notes from a checker-board survey, the student will properly lay out a grid and plot each elevation on the grid. Understand basic survey terminology. Calculate land area by acres.

EVALUATION PROCEDURE:

The instructor will check the grid and elevations for accuracy, neatness and correctness.

RESOURCES:

Basic Drafting Furniture
Basic Drafting Instruments
Drafting Arm or Machine
Technical Drawing, Chapter 23
Basic Technical Drawing, Chapter 21 (Figure 21-1)

PROCEDURE:

1. Obtain a sheet of 18" x 24" drawing paper.
2. Using a scale of 1"=200', draw a plat plan of the "Howard Tract" found on figure 21.1 in the resource book.
3. Starting at the center line of State Highway No. 83, lay out horizontal grid lines parallel to center line at 100' intervals above and below the highway until total "Howard Tract" is covered.
4. Beginning at the western most point on the Howard Tract, start laying out parallel vertical grid lines at 100' intervals toward the East running perpendicular to the horizontal grid lines. Make sure they also cover entire area.
5. Have the instructor check both the vertical and horizontal grid lines to be sure you've done it correctly before proceeding to the next step.
6. Label the vertical grid lines with letters. Begin at the western most point and letter it "H". Proceed east labeling each vertical grid line (I, J, K, etc.) then west, reversing the procedure.
7. Label the horizontal grid lines with numbers. Begin at the south side and proceed north labeling each horizontal grid line (1, 2, 3, 4, etc.). HINT: Grid coordinate "9" maintains a 60' elevation which is the elevation of the center of highway 85#.)
8. Using the elevations given in the surveyor's notes, plot each elevation to it's corresponding coordinate on the grid. (See attached notes)
9. Calculate the Howard Tract land area in acres north of Highway 85. Show your work and be able to explain your method to the instructor.
10. Keep this work on your board as it will be used for the next LAP. NOTE: This is not the only method of laying out a grid to plot points. Check with the instructor.

Principal Author(s): C. Wetterling and C. Lynch
Revised: Jere Wheatley

LOC. EVEL.

B

B --- 11 ------ 54
B --- 12 ------ 54
B --- 13 ------ 50

C

C --- 10 ------ 59
C --- 11 ------ 57
C --- 12 ------ 48
C --- 13 ------ 44
C --- 14 ------ 40
C --- 15 ------ 36

D

D --- 9 ------ 60
D --- 10 ------ 53
D --- 11 ------ 50
D --- 12 ------ 43
D --- 13 ------ 38
D --- 14 ------ 35
D --- 15 ------ 34
D --- 16 ------ 34
D --- 17 ------ 34
D --- 18 ------ 30

E

E --- 2 ------ 43
E --- 3 ------ 46
E --- 4 ------ 51

LOC. EVEL.

E --- 5 ------ 56
E --- 6 ------ 56
E --- 7 ------ 54
E --- 8 ------ 57
E --- 9 ------ 60
E --- 10 ------ 52
E --- 11 ------ 46
E --- 12 ------ 38
F --- 13 ------ 35
E --- 14 ------ 36
E --- 15 ------ 39
E --- 16 ------ 41
E --- 17 ------ 41
E --- 18 ------ 39
E --- 19 ------ 36
E --- 20 ------ 31
E --- 21 ------ 28

F

F --- 2 ------ 47
F --- 3 ------ 52
F --- 4 ------ 57
F --- 5 ------ 62
F --- 6 ------ 64
F --- 7 ------ 60
F --- 9 ------ 60
F --- 10 ------ 50
F --- 11 ------ 42
F --- 12 ------ 35

LOC. EVEL.

F --- 13 ------ 40
F --- 14 ------ 49
F --- 15 ------ 50
F --- 16 ------ 54
F --- 17 ------ 54
F --- 18 ------ 48
F --- 19 ------ 43
F --- 20 ------ 38
F --- 21 ------ 33
F --- 22 ------ 34

G

G --- 2 ------ 50
G --- 3 ------ 55
G --- 4 ------ 60
G --- 5 ------ 64
G --- 6 ------ 70
G --- 7 ------ 65
G --- 8 ------ 60
G --- 9 ------ 60
G --- 10 ------ 51
G --- 11 ------ 41
G --- 12 ------ 37
G --- 13 ------ 43
G --- 14 ------ 52
G --- 15 ------ 52
G --- 16 ------ 55
G --- 17 ------ 55
G --- 18 ------ 55

LOC. EVEL.

G --- 19 ------ 50
G --- 20 ------ 49
G --- 21 ------ 40
G --- 22 ------ 38
G --- 23 ------ 37
G --- 24 ------ 36
G --- 25 ------ 38
G --- 26 ------ 38

H

H --- 2 ------ 54
H --- 3 ------ 56
H --- 4 ------ 64
H --- 5 ------ 70
H --- 6 ------ 76
H --- 7 ------ 75
H --- 8 ------ 65
H --- 9 ------ 60
H --- 10 ------ 52
H --- 11 ------ 40
H --- 12 ------ 39
H --- 13 ------ 49
H --- 14 ------ 53
H --- 15 ------ 55
H --- 16 ------ 65
H --- 17 ------ 66
H --- 18 ------ 63
H --- 19 ------ 60
H --- 20 ------ 51

LOC. EVEL.

H --- 21 ------ 49
H --- 22 ------ 48
H --- 23 ------ 49
H --- 24 ------ 49
H --- 25 ------ 45
H --- 26 ------ 45
H --- 27 ------ 38
H --- 28 ------ 29
H --- 29 ------ 24

I

I --- 2 ------ 57
I --- 3 ------ 58
I --- 4 ------ 66
I --- 5 ------ 75
I --- 6 ------ 84
I --- 7 ------ 85
I --- 8 ------ 68
I --- 9 ------ 60
I --- 10 ---- - 55
I --- 11 ------ 41
I --- 12 ------ 40
I --- 13 ------ 45
I --- 14 ------ 54
I --- 15 ------ 60
I --- 16 ------ 69
I --- 17 ------ 70
I --- 18 ------ 69
I --- 19 ------ 70

LOC. EVEL.

I --- 20 ------ 69
I --- 21 ------ 52
I --- 22 ------ 53
I --- 23 ------ 56
I --- 24 ------ 56
I --- 25 ------ 55
I --- 26 ------ 45
I --- 27 ------ 42
I --- 28 ------ 36

J

J --- 2 ------ 58
J --- 3 ------ 62
J --- 4 ------ 68
J --- 5 ------ 72
J --- 6 ------ 89
J --- 7 ------ 90
J --- 8 ------ 70
J --- 9 ------ 60
J --- 10 ------ 53
J --- 11 ------ 45
J --- 12 ------ 39
J --- 13 ------ 49
J --- 14 ------ 50
J --- 15 ------ 60
J --- 16 ------ 72
J --- 17 ------ 80
J --- 18 ------ 80
J --- 19 ------ 89

LOC. EVEL.

J --- 20 ------ 72
J --- 21 ------ 69
J --- 22 ------ 51
J --- 23 ------ 52.5
J --- 24 ------ 52
J --- 25 ------ 52
J --- 26 ------ 49
J --- 27 ------ 44
J --- 28 ------ 36

K

K --- 2 ------ 64
K --- 3 ------ 66
K --- 4 ------ 69
K --- 5 ------ 72
K --- 6 ------ 90
K --- 6.33 ---100
K --- 6.66 ---100
K --- 7 ------ 91
K --- 8 ------ 72
K --- 9 ------ 60
K --- 10 ------ 51
K --- 11 ------ 46
K --- 12 ------ 39
K --- 13 ------ 42
K --- 14 ------ 45
K --- 15 ------ 56
K --- 16 ------ 65
K --- 17 ------ 80

LOC. EVEL.

K --- 18 ------ 90
K --- 18.5 ---- 90
K --- 19 ------ 91
K --- 20 ------ 81
K --- 21 ------ 72
K --- 22 ------ 66
K --- 23 ------ 62
K --- 24 ------ 56
K --- 25 ------ 53
K --- 26 ------ 47

L

L --- 2 ------ 66
L --- 3 ------ 72
L --- 4 ------ 70
L --- 5 ------ 75
L --- 6 ------ 90
L --- 6.33 ---100
L --- 6.66 ---100
L --- 7 ------ 90
L --- 8 ------ 71
L --- 9 ------ 60
L --- 10 ------ 50
L --- 11 ------ 39
L --- 12 ------ 30
L --- 13 ------ 45
L --- 14 ------ 47
L --- 15 ------ 50
L --- 16 ------ 64

LOC. EVEL.

L --- 17 ------ 70
L --- 17.5 ---- 80
L --- 18 ------ 90
L --- 19 ------100
L --- 20 ------ 82
L --- 21 ------ 71
L --- 22 ------ 67
L --- 23 ------ 65
L --- 24 ------ 61
L --- 26 ------ 46

M

M --- 2 ------ 64
M --- 3 ------ 74
M --- 4 ------ 79
M --- 5 ------ 85
M --- 6 ------ 92
M --- 7 ------ 85
M --- 8 ------ 70
M --- 9 ------ 60
M --- 10 ------ 52
M --- 10.5 ---- 40
M --- 11 ------ 35
M --- 12 ------ 25
M --- 13 ------ 37
M --- 14 ------ 46
M --- 15 ------ 46
M --- 16 ------ 60
M --- 17 ------ 61

LOC. EVEL.

M --- 18 ------ 79
M --- 19 ------ 90
M --- 20 ------ 80
M --- 21 ------ 65
M --- 22 ------ 64
M --- 23 ------ 64
M --- 24 ------ 61
M --- 25 ------ 52

N

N --- 2 ------ 60
N --- 3 ------ 70
N --- 4 ------ 80
N --- 5 ------ 90
N --- 6 ------ 90
N --- 7 ------ 78
N --- 8 ------ 65
N --- 9 ------ 60
N --- 10 ------ 55
N --- 10.5 ---- 40
N --- 11 ------ 35
N --- 12 ------ 20
N --- 13 ------ 20
N --- 14 ------ 33
N --- 15 ------ 40
N --- 16 ------ 57
N --- 17 ------ 65
N --- 18 ------ 75
N --- 19 ------ 85

LOC. EVEL.

N --- 20 ------ 76
N --- 21 ------ 63
N --- 22 ------ 62
N --- 23 ------ 61
N --- 24 ------ 59

0

0 --- 2 ------ 57
0 --- 3 ------ 68
0 --- 4 ------ 78
0 --- 5 ------ 88
0 --- 6 ------ 73
0 --- 7 ------ 70
0 --- 8 ------ 63
0 --- 9 ------ 60
0 --- 10 ------ 55
0 --- 10.5 ---- 40
0 --- 11 ------ 33
0 --- 12 ------ 18
0 --- 12.5 ---- 10
0 --- 13 ------ 10
0 --- 14 ------ 30
0 --- 15 ------ 40
0 --- 16 ------ 58
0 --- 17 ------ 69
0 --- 18 ------ 75
0 --- 19 ------ 81
0 --- 19.5 ---- 80
0 --- 20 ------ 72

LOC. EVEL.

0 --- 21 ------ 66
0 --- 22 ------ 63
0 --- 23 ------ 59

P

P --- 2 ------ 53
P --- 3 ------ 63
P --- 4 ------ 68
P --- 5 ------ 78
P --- 6 ------ 70
P --- 7 ------ 65
P --- 8 ------ 58
P --- 9 ------ 60
P --- 10 ------ 50
P --- 11 ------ 34
P --- 11.5 ---- 20
P --- 12 ------ 9
P --- 12.5 ---- 10
P --- 13 ------ 20
P -- 13.5 ---- 30
P --- 14 ------ 37
P --- 15 ------ 47
P --- 16 ------ 59
P --- 17 ------ 70
P --- 18 ------ 74
P --- 19 ------ 75
P --- 20 ------ 73
P --- 21 ------ 65
P --- 22 ------ 60.5

LOC. EVEL.

P --- 23 ------ 58

Q

Q --- 2 ------ 51
Q --- 3 ------ 56
Q --- 4 ------ 65
Q --- 5 ------ 76
Q --- 6 ------ 66
Q --- 7 ------ 60
Q --- 8 ------ 57
Q --- 9 ------ 60
Q --- 10 ------ 47
Q --- 11 ------ 36
Q --- 12 ------ 20
Q --- 13 ------ 32
Q --- 14 ------ 48
Q --- 15 ------ 51
Q --- 16 ------ 61
Q --- 17 ------ 69
Q --- 18 ------ 72
Q --- 19 ------ 73
Q --- 20 ------ 70
Q --- 21 ------ 63
Q --- 22 ------ 59

R

R --- 2 ------ 47
R --- 3 ------ 53
R --- 4 ------ 67

LOC. EVEL.

R --- 4.5 ---- 80
R --- 5 ------ 81
R --- 6 ------ 62
R --- 7 ------ 59
R --- 8 ------ 59
R --- 9 ------ 60
R --- 10 ------ 48
R --- 11 ------ 37
R --- 12 ------ 20
R --- 13 ------ 35
R --- 14 ------ 50
R --- 15 ------ 52
R --- 16 ------ 62
R --- 17 ------ 68
R --- 18 ------ 71
R --- 19 ------ 71
R --- 20 ------ 67
R --- 21 ------ 63
R --- 22 ------ 57

S

S --- 2 ------ 49
S --- 3 ------ 57
S --- 4 ------ 70
S --- 5 ------ 89
S --- 6 ------ 61
S --- 7 ------ 59
S --- 8 ------ 53
S --- 9 ------ 60

LOC. EVEL.

S --- 10 ------ 47
S --- 11 ------ 43
S --- 12 ------ 35
S --- 13 ------ 43
S --- 14 ------ 53
S --- 15 ------ 55
S --- 16 ------ 59
S --- 17 ------ 67
S --- 18 ------ 67
S --- 19 ------ 66
S --- 20 ------ 66
S --- 21 ------ 64
S --- 22 ------ 65

T

T --- 2 ------ 50
T --- 3 ------ 60
T --- 4 ------ 71
T --- 4.5 ---- 90
T --- 4.75 --- 90
T --- 5 ------ 88
T --- 6 ------ 70
T --- 7 ------ 57
T --- 8 ------ 50
T --- 9 ------ 60
T --- 10 ------ 56
T --- 11 ------ 46
T --- 12 ------ 37
T --- 13 ------ 45

LOC. EVEL.

T --- 14 ------ 51
T --- 15 ------ 56
T --- 16 ------ 57
T --- 17 ------ 63
T --- 18 ------ 65
T --- 19 ------ 64.5
T --- 20 ------ 66
T --- 21 ------ 59

U

U --- 2 ------ 56
U --- 3 ------ 62
U --- 4 ------ 80
U --- 4.66 --- 90
U --- 5 ------ 88
U --- 6 ------ 67
U --- 7 ------ 58
U --- 8 ------ 49
U --- 9 ------ 60
U --- 10 ------ 55
U --- 11 ------ 50
U --- 12 ------ 40
U --- 13 ------ 40
U --- 14 ------ 49
U --- 15 ------ 54
U --- 16 ------ 56
U --- 17 ------ 58
U --- 18 ------ 62
U --- 19 ------ 64

LOC. EVEL.

U --- 20 ------ 61

U --- 21 ------ 54

V

V --- 2 ------ 58

V --- 3 ------ 68

V --- 4 ------ 90

V --- 4.4 ---- 90

V --- 5 ------ 80

V --- 6 ------ 61

V --- 7 ------ 59

V --- 8 ------ 49

V --- 9 ------ 60

V --- 11 ------ 54

V --- 12 ------ 42

V --- 13 ------ 36

V --- 14 ------ 45

V --- 15 -- --- 55

V --- 16 ------ 56

V --- 17 --- -- 58

V --- 18 ------ 59

V --- 19 ------ 59

V --- 20 ------ 54

V --- 21 ------ 56

W

W --- 2 ------ 62

W --- 3 ------ 66

W --- 4 ------ 72

LOC. EVEL.

W --- 5 ------ 70

W --- 6 ------ 58

W --- 7 ------ 50

W --- 8 ------ 49

W --- 9 ------ 60

W --- 11 ------ 53

W --- 12 ------ 45

W --- 13 ------ 36

W --- 14 ------ 41

W --- 15 ------ 49

W --- 16 ------ 53

W --- 17 ------ 53

W --- 18 ------ 56

X

X --- 2 ------ 58

X --- 3 ------ 58

X --- 4 ------ 55

X --- 5 ------ 60

X --- 6 ------ 55

X --- 7 ------ 47

X --- 8 ------ 51

X --- 9 ------ 60

X --- 11 ------ 54

X --- 12 ------ 46

X --- 13 ------ 38

X --- 14 ------ 37

X --- 15 ------ 45

X --- 16 ------ 47

LOC. EVEL.

X --- 17 ------ 51

X --- 18 ------ 49

Y

Y --- 7 ------ 53

Y --- 11 ------ 58

Y --- 12 ------ 48

Y --- 13 ------ 39

Y --- 14 ------ 39

Y --- 15 ------ 45

Y --- 16 ------ 43

Y --- 17 ------ 47

Y --- 18 ------ 53

Z

Z --- 12 ------ 52

Z --- 13 ------ 43

Z --- 14 ------ 43

LOC. EVEL.

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Page ____

LOC.	EVEL.	LOC.	EVEL.	LOC.	EVEL.	LOC.	EVEL.

Page ______

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Mountain-Plains Education &
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Program, Inc.
(Glasgow AFB, Montana 59231)

File Code: 79.01.12.03

Date Published: 5-4-77
Revised: 5-17-78

Learning Activity Package

Student: ____________

Date: ____________

PERFORMANCE ACTIVITY: Contour Map

OBJECTIVE:

Using plotted elevations, the student will be able to properly draw a contour map and understand it's purpose and related terminology.

EVALUATION PROCEDURE:

The instructor will check the contour map for neatness, accuracy, and correctness. A multiple choice unit test will be used to check the student's understanding of the map's purpose and also related terminology.

RESOURCES:

Basic Drafting Furniture
Basic Drafting Instruments
Technical Drawing, Chapter 23
Basic Technical Drawing, Chapter 21

PROCEDURE:

1. Review the resources, book(s) listed above.
2. Using the survey grid blueprint made in the previous LAP, interpolate and locate each 10 foot elevation. NOTE: Start at the highest or lowest points where they are closely spaced and work outward.
3. On the grid blueprint draw each contour line by connecting proper points.
4. Have the instructor check the drawing.
5. When approved by the instructor, make a completed original of the contour map in ink by tracing over the grid blueprint.
6. All lettering and numbering should be done using a LeRoy lettering guide.
7. Before reproducing the contour map, draw a heavy line from I-29 to W-2. This is your profile cutting plane.

Principal Author(s): C. Wetterling, C. Lynch, and J. Wheatley

Mountain-Plains Education &
Economic Development
Program, Inc.
Glasgow AFB, Montana 59231

File Code: 79.01.12.04

Date Published: 5-4-77
Revised: 5-17-78

Learning Activity Package

Student: ____________________

Date: ____________________

PERFORMANCE ACTIVITY: Profiles

OBJECTIVE:

Given a contour map, the student will be able to draw a profile of any given location.

EVALUATION PROCEDURE:

The instructor will check the profile for neatness, accuracy, and correctness. A multiple unit test will be used to check concepts and understanding.

RESOURCES:

Basic Drafting Furniture
Basic Drafting Instruments
Technical Drawing, Chapter 23
Basic Technical Drawing, Chapter 21

PROCEDURE:

1. Review the above resource book(s).
2. Draw a profile showing the part of the Howard Tract which is located along a line from coordinate I-29 to W-2.
3. Use a scale of 1"=200' for the horizontal distances and use a scale of ½"=10' for vertical distances.

   NOTE: The edge of the highway is at an elevation of 59'6". The ditch lies from the edge of the highway out 70' and its lowest point lies midway at an elevation of 55'.

4. The drawing will be done in ink on a 12" x 18" sheet of Mylar. Lettering will be LeRoy.

Principal Author(s): C. Wetterling, C. Lynch, and J. Wheatley

Family Education Program

File Code: 79.01.13.00.B1-0

Date Published: 10/7/77
Revised: 1/25/80

Learning Experience Guide

UNIT: DEVELOPMENTS AND INTERSECTIONS

RATIONALE:

Thousands of products are manufactured by cutting out the pattern and then folding them into shape. Some examples are air-conditioning ducts, pans, buckets, milk cartons and paper cups. In sheet metal work, development means the laying out of a pattern. It is therefore necessary for any draftsman, plumber, and heating and ventilation mechanic, to be able to develop an object on a flat surface before he can form his object or describe the object correctly.

REREQUISITES:

Unit: 79.01.11 Pictorial Drawings

OBJECTIVES:

Layout parallel, radial-line, intersection, and triangulation developments given an illustration and dimensions. Form these patterns into the objects.

Identify terms and definitions for and characteristics of parallel, radial-line, and triangulation developments.

RESOURCES:

Printed Materials

Basic Technical Drawing. Spencer & Drydon; Macmillian Company, New York.
Engineer Drawing and Graphic Technology. French & Vierck; Eleventh Edition; McGraw-Hill Book Company, New York.
Mechanical Drawing. French & Sevenson; Webster Division, McGraw-Hill Book Company, New York.
Technical Drawing. Gieseche, Mitchell, Spencer & Hill; Sixth Edition, Macmillian Company, New York.
Drafting Technology. Rotmans and Horton; Delmar Publishers.
Exploring Drafting. John Walker; Goodheart-Willcox, Illinois.
Practical Drafting for HVAC. Traister; Howard W. Sams Publishing, New York.

Equipment

See Course LEG.

Audio Visual

Video cassette on Development.

Principal Author(s): Jere Wheatley

GENERAL INSTRUCTIONS:

This unit consists of four Learning Activity Packages (LAPS). Each LAP will provide specific information for completion of a learning activity.

The general procedure for this unit is as follows:

1. Read the first assigned Learning Activity Package (LAP).
2. Begin and complete the first assigned LAP.
3. When the drawing of the layout is completed, have the instructor evaluate it.
4. Cut-out and tape the construction so that it can be checked and approved.
5. Take LAP test if indicated.
6. Proceed to and complete the next assigned LAP in the unit.
7. Complete all required LAP's for the unit by following Steps 3-5.
8. Take the unit tests as described in the Unit LEG "Evaluation Procedures".
9. Proceed to the next assigned unit.

LAP ACTIVITIES:

.01 Parallel Line Development
.02 Radial-Line Development
.03 Intersection
.04 Triangulation

EVALUATION PROCEDURE:

1. The student takes a multiple-choice post test and turns it in for correction.

2. The student takes a unit performance test. Successful unit completion is meeting the listed criteria for the performance test.

FOLLOW-THROUGH:

Begin the first assigned Learning Activity Package (LAP) for this unit.

File Code: 79.01.13.01.A1-0

Date Published: 1/28/80

Family Education Program

Learning Activity Package

Student: ____________________

Date: ____________________

PERFORMANCE ACTIVITY: Parallel Line Development

OBJECTIVE:

Using parallel line development lay out and construct HVAC ductwork, consisting of a square elbow, a rectangular off-set, and a rectangular-to-square transition.

EVALUATION PROCEDURE:

Instructor will examine the layout and the construction. No more than one error per object will be allowed.

RESOURCES:

Basic Technical Drawing, pp. 341-345 (para. 17.1-17.5) and pp. 355-356 (para. 17.22)
Drafting Technology, pp. 230-237
Mechanical Drawing, pp. 291-297
Exploring Drafting, pp. 150-159 (Unit 12)
Practical Drafting for HVAC, pp. 121-131 (Unit 11)

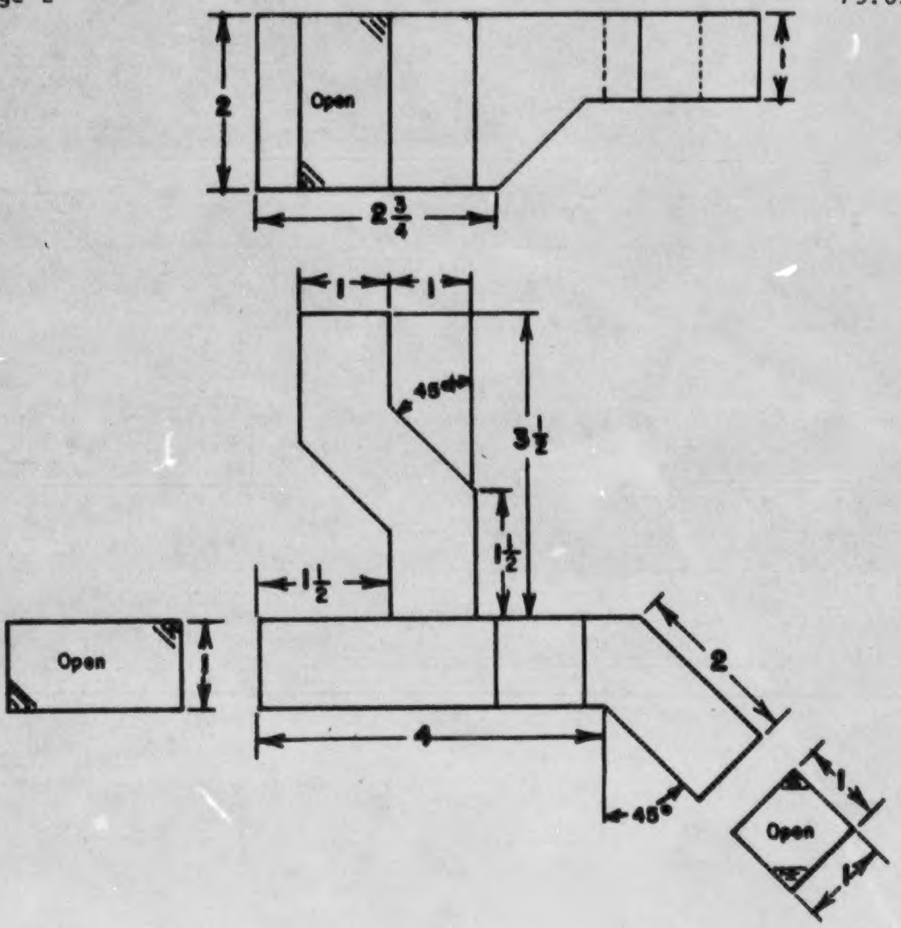
Basic Drafting Tools: (See Unit LEG)
Drafting Furniture: (See Unit LEG)

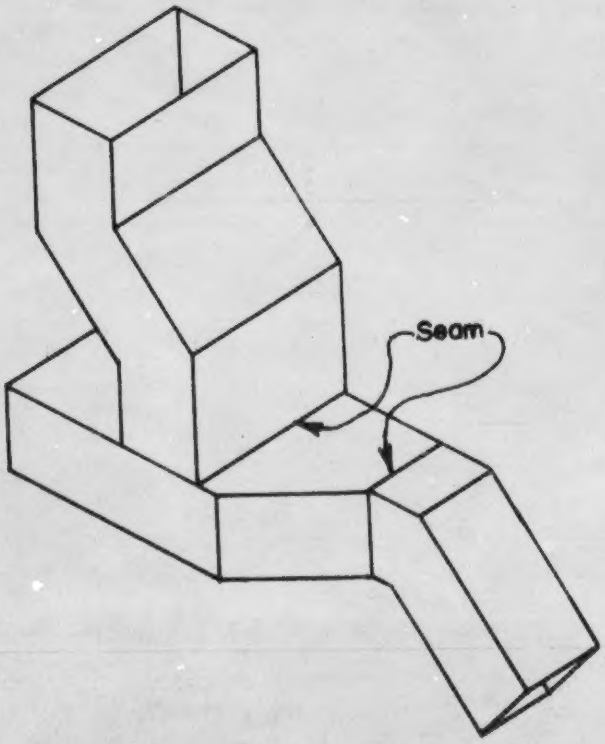
Audio visual: Video cassette on Developments

PROCEDURE:

1. Read the resource(s).
2. The HVAC ducting illustrated will be constructed in the following manner:
    a. The ducting consists of three separate pieces. Each will be laid out so that it can be cut from one piece of paper.
    b. Tabs will be provided for ease of assembly.
    c. The entire object will be cut out and taped together.
3. Have the instructor evaluate the duct. Take the LAP test then proceed to LAP .02.

Principal Author(s): Jere Wheatley


2
Open
2 3/4
1
1
1
45°
3 1/2
1 1/2
1 1/2
Open
1
2
4
45°
Open
1
1



HINT: Remember, this duct is constructed of 3 separate parts. Each part to be a one piece pattern.

File Code: 79.01.13.02.A1-0

Date Published: 1/28/80

Family Education Program

Learning Activity Package

Student: ____________

Date: ____________

PERFORMANCE ACTIVITY: Radial Line Development

OBJECTIVE:

Using radial line development, the student will construct a funnel and a square grain spout.

EVALUATION PROCEDURE:

Instructor will examine each layout against a prepared key. No more than one error per object will be allowed.

RESOURCES:

Basic Technical Drawing, pg. 352 (para. 17.16)
Drafting Technology, pp. 260-261
Mechanical Drawing, pg. 302 (para. 20.19)
Exploring Drafting, pp. 150-154 (Unit 12)

Basic Drafting Tools: (See Unit LEG)
Drafting Furniture: (See Unit LEG)

PROCEDURE:

1. Read the above resource(s).

2. Construct the funnel illustrated on page 2.

   a. Draw an orthographic view of the object to full scale.
   b. Use radial line development as described on page 364 of Basic Technical Drawing and complete the pattern.
   c. The pattern will develop as two pieces.

3. Construct the grain spout shown on page 2.

   a. Draw the orthographic views needed to full scale.
   b. Using radial line development, complete the pattern as described in Basic Technical Drawing.
   c. The pattern should be in one piece.

4. Have the instructor evaluate the completed layouts.

5. Cut out the layouts and tape them together.

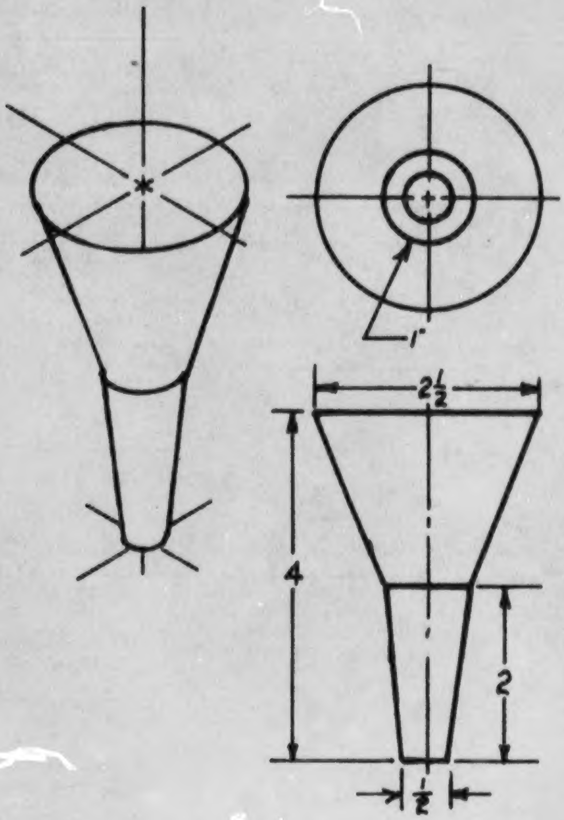
6. Turn in your construction to your instructor for evaluation.

Principal Author(s):

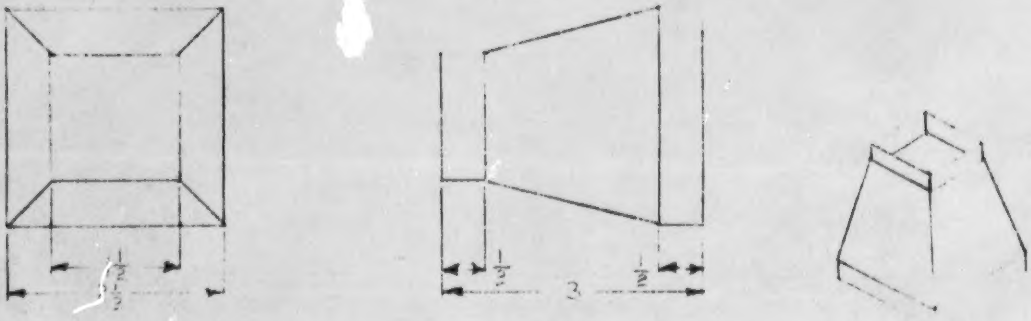
Jere Wheatley

Family Training Center, Inc.

FUNNEL



GRAIN SPOUT



File Code: 79.01.13.03.A1-0

Date Published: 1/28/80

Family Education Program

Learning Activity Package

Student: __________

Date: __________

PERFORMANCE ACTIVITY: Intersecting Roof Flanges and Round Pipe Joints

OBJECTIVE:

Lay out and construct a round "T" stack intersecting a roof flange.

EVALUATION PROCEDURE:

Instructor will examine layout against a prepared key. No more than one error on each part will be allowed.

RESOURCES:

Basic Technical Drawing, pp. 341-344 (para. 17.1-17.3), pg. 358 (para. 17.26) and pg. 363 (Figure 17.33)
Drafting Technology, pp. 238-239 and pg. 246
Exploring Drafting, pp. 150-159 (Unit 12)

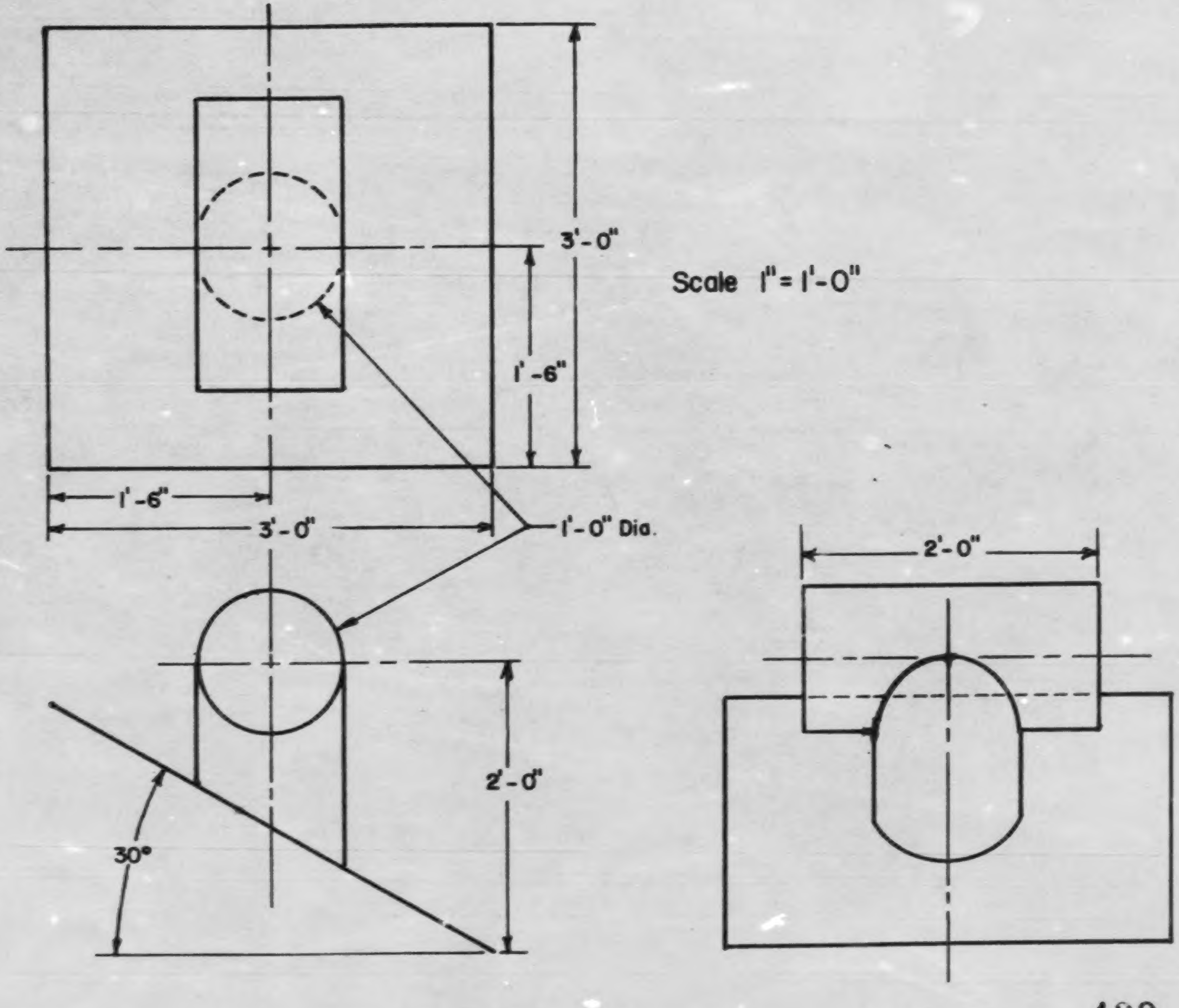
Basic Drafting Tools: (See Unit LEG)
Drafting furniture: (See Unit LEG)

PROCEDURE:

1. Read the above resource(s).
2. Construct the object illustrated on page 2.
    a. Draw the 3 orthographic views of the object to 1" = 1'-0" scale.
    b. Use parallel line development as described in the resources.
    c. The pattern will be drawn as three pieces.
3. Have the completed layouts evaluated by the instructor.
4. Cut out the layout and tape them together.
5. Turn in your construction to your instructor for evaluation.
6. Take the LAP test and proceed to LAP .04.

Principal Author(s): Jere Wheatley

Family Training Center, Inc.


3'-0"
1'-6"
1'-6"
3'-0"
1'-0" Dia.
Scale 1"= 1'-0"
2'-0"
2'-0"
30°

File Code: 79.01.13.04.A1-0

Date Published: 1/28/80

Family Education Program

Learning Activity Package

Student: ____________________

Date: ____________________

PERFORMANCE ACTIVITY: Development by Triangulation

OBJECTIVE:

Lay out and construct a rectangular-to-round duct transition piece.

EVALUATION PROCEDURE:

Instructor will examine layout against a prepared key. No more than one error per object will be allowed.

RESOURCES:

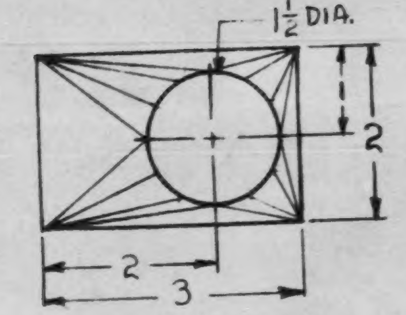
Basic Technical Drawing, pg. 355 (para. 17.21)
Engineering Drawing and Graphic Technology, pp. 335-339

Basic Drafting Tools: (See Unit LEG)
Drafting Furniture: (See Unit LEG)

PROCEDURE:

1. Read the above resource(s).
2. Develop and lay out the transition piece shown on page 2, using the following steps.
    a. Draw the 2 orthographic views to full scale.
    b. Use triangulation as described in the resources.
    c. Develop the pattern in one piece.
3. Have the completed layout evaluated.
4. Cut out and tape the construction together.
5. Turn in your construction to your instructor for evaluation.
6. Take the LAP test and proceed to the performance test.

Principal Author(s): Jere Wheatley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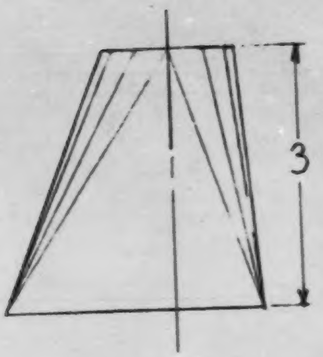
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Student: ____________ File Code: 79.01.13.00.A1-5

Date: ____________ Date Published: 10/7/77

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Glasgow AFB, Montana 59231

UNIT PERFORMANCE TEST: DEVELOPMENTS

OBJECTIVE:

The student will lay out and construct a transition piece using triangulation.

TASK:

The student will produce the transition piece illustrated for this performance test.

ASSIGNMENT:

The student will do the following:

a. Develop the pattern in one piece.
b. Assemble the pattern to make the object conform with the check list.

CONDITIONS:

The drawing is to be completed in the drafting room, using the complete facilities. The student will not use the instructor or other students as resources.

RESOURCES:

As listed in the LEG.

Student: ______________________ File Code: 79.01.13.00.A1-5

Date: ______________________ Date Published: 10/7/77

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PERFORMANCE CHECKLIST:

OVERALL PERFORMANCE: Satisfactory_____ Unsatisfactory_____

	CRITERION	
	Met	Not Met
OBJECTIVE 1:		
1. The entire object will be constructed and taped together		
Criterion: No parts missing		
OBJECTIVE 2:		
2. The object is neat		
Criterion: No unnecessary folds, cut edges even, object clean		
OBJECTIVE 3:		
3. All seams of the object join accurately		
Criterion: No gaps larger than 1/32" - taping must be even		
OBJECTIVE 4:		
4. All dimensions of the object are to correct scale		
Criterion: All measurements within 1/32"		
OBJECTIVE 5:		
5. The proper and correct method will be used for the lay out		
Criterion: Lay out per instructions in Basic Technical		

(Checklist continued)

	CRITERION	
	Met	Not Met
Drawing, 17.21, pg. 355		
OBJECTIVE 6:		
6. The drawing is completed within the specified time limit		
Criterion: Not to exceed 4 hours		
Student must meet criterion on 5 line items to obtain an		
overall score of satisfactory.		

Student: ______________________ File Code: 79.01.13.00:B2-2

Date: ______________________ Date Published: 3-8-79

Family Education Program

UNIT PRE/POST TEST: DEVELOPMENTS AND INTERSECTIONS

1. Which of the following is not a development method?

   a. parallel line
   b. perpendicular line
   c. radial line
   d. triangulation

2. In developments, each line length on the pattern is:

   a. taken from the top and front view.
   b. taken from the top and R.S. view.
   c. half size
   d. true length

3. An object which has it's surfaces parallel to an axis is a regular prism. Which method is used to develop a prism?

   a. parallel line
   b. perpendicular line
   c. radial line
   d. triangulation

4. A regular polyhedron (prism, pyramid, cone, etc.) which has one end cut off is said to be:

   a. shortened
   b. intersected
   c. truncated
   d. irregular

5. A regular polyhedron whose sides meet at a common vertex is developed by:

   a. parallel line
   b. perpendicular line
   c. radial line
   d. triangulation

6. A fitting that makes a change from one size or shape to another is called:

   a. an adjustor
   b. an intersector
   c. a development
   d. a transition piece

7. A drawing of all surfaces of an object to make a pattern is called:

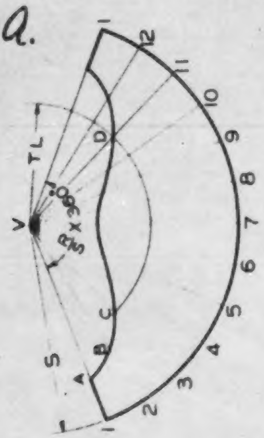
   a. developments
   b. auxiliary drawing
   c. full scale drawing
   d. surface drawing

8. Some objects are irregular polyhedrons which must be developed using:

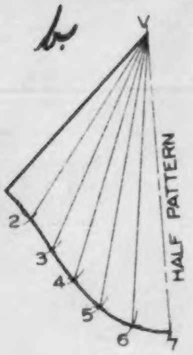
   a. parallel line
   b. perpendicular line
   c. radial line
   d. triangulation

9. Which of the patterns below will develop into a truncated cone?

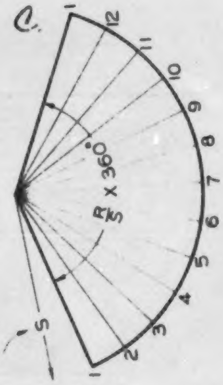
a.


1
12
11
10
9
8
7
6
5
4
3
2
1
TL
D
C
B
A
V
S
R/S x 360°

b.


V
1
2
3
4
5
6
7
HALF PATTERN

c.


1
12
11
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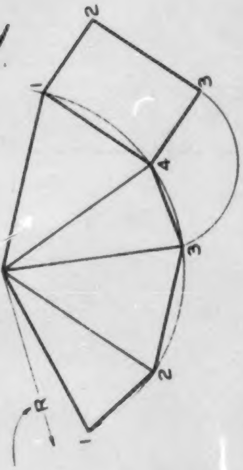
2
1
S
R/S x 360°

d.



10. Which of the patterns above will develop into an oblique cone?

UNIT PRE/POST TEST ANSWER KEY: DEVELOPMENTS AND INTERSECTIONS

1. B
2. D
3. A
4. C
5. C
6. D
7. A
8. D
9. A
10. B

Student: ______________________ **File Code:** 79.01.13.00.B4-0

Date: ______________________ **Date Published:** 2/21/80

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UNIT PERFORMANCE TEST: DEVELOPMENTS

OBJECTIVES:

1. The student will lay out and construct an object using parallel lines.
2. The student will lay out and construct an object using radial lines.
3. The student will lay out and construct an object using triangulation.

TASK:

The student will produce the objects illustrated for this performance test.

ASSIGNMENT:

The student will do the following:

a. Develop the pattern of each object.
b. Assemble the pattern to make the object conform with the check list.

CONDITIONS:

The drawing is to be completed in the drafting room, using the complete facilities. The student will not use the instructor or other students as resources.

RESOURCES:

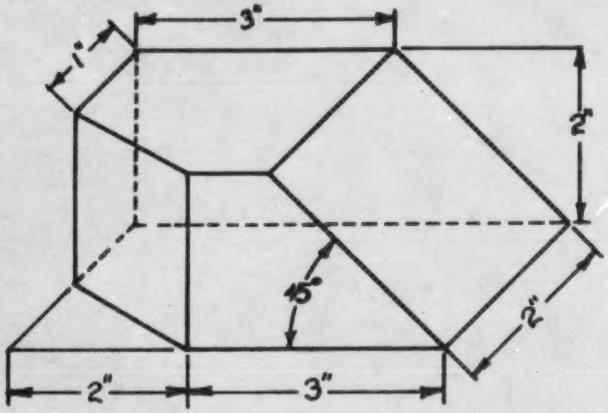
As listed in the LEG.

ASSIGNED TASK:

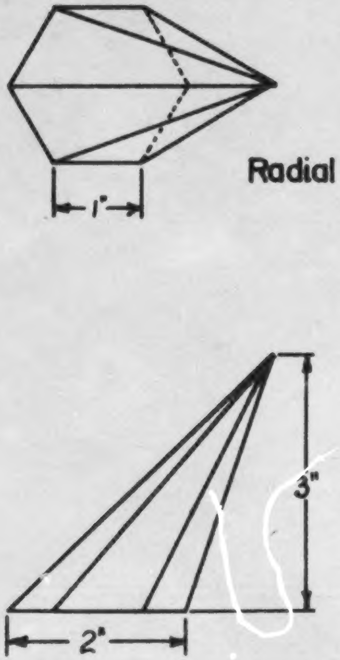
To develop the 3 assigned objects illustrated to meet the criterion on the check list.

PROCEDURE:

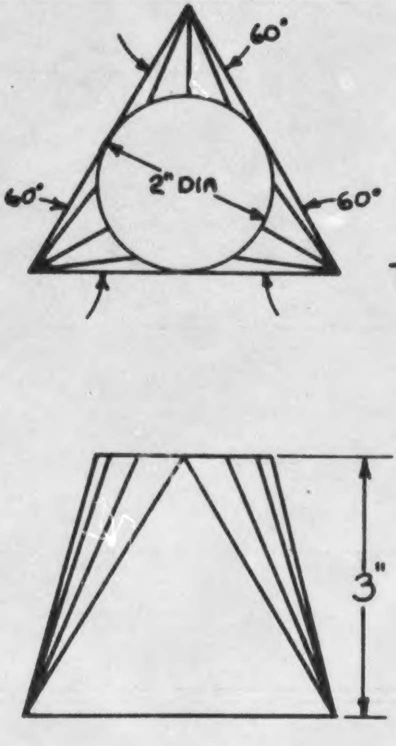
Use the previous LAPs and the resources as a procedural guide.



Parallel



Radial


60°
60°
60°
2" DIA
3"

Triangulation

Student: ____________________ File Code: 79.01.13.00.B4-0

Date: ____________________ Date Published: 2/21/80

Family Education Program

PERFORMANCE CHECKLIST:

OVERALL PERFORMANCE: Satisfactory ____ Unsatisfactory ____

	CRITERION	
	Met	Not Met
OBJECTIVE 1:		
1. The object formed by parallel line development is complete.		
2. The object formed by radial line development is complete.		
3. The object formed by triangulation is complete.		
CRITERION: No parts missing.		
OBJECTIVE 2:		
4. The three objects are to correct scale.		
CRITERION: All measurements within 1/32".		
OBJECTIVE 3:		
5. The three objects are neat.		
CRITERION: No unnecessary folds, cut edges even, objects clean		
with no extra lines and smudges.		
OBJECTIVE 4:		
6. The three objects are formed by the proper methods.		
CRITERION: Methods specified in "Basic Technical Drawing"		
OBJECTIVE 5:		
7. Objects completed within specified time.		
CRITERION: Not to exceed 4 hours.		

Family Education Program

File Code: 79.01.14.00

Date Published: 11-17-78
Revised: 8-13-79

Learning Experience Guide

UNIT: WORKING DRAWINGS

RATIONALE:

It is the job of the draftsman to draw the working drawings from engineers' notes or sketches. These working drawings must provide all the information necessary to enable the object to be produced. This information must be presented in a standard form common to any company.

PREREQUISITES:

Unit: 79.01.13 -- Intersections and Developments

OBJECTIVES:

Prepare a set of working drawings that would enable a machinist or craftsman to make the object.
Identify terms and definitions used with working drawings.
Identify purpose and characteristics of various working drawings.

RESOURCES:

Printed Materials

Basic Technical Drawing. Spencer and Drydon, Macmillan Company, New York.
Catalog collection (Building Trades and Supplies).
Engineering Drawing and Graphic Technology. French and Vierck, Eleventh Edition, McGraw-Hill Book Company, New York.
Mechanical Drawing. French and Svenson, Webster Division, McGraw-Hill Book Company, New York.
Technical Drawing. Sixth Edition, Gieseche, Mitchell, Spencer and Hill, Macmillan Company, New York.
Design Drafting, James Earle, Addison-Wesley, New York.
GM Engineering Standards, General Motors Engineering Staff.

Equipment

Basic Drafting Tools: See Course LEG
Blue/Black line printer
Cutter, paper (24" or larger)
Drafting Furniture: stool, drafting
table, drafting (with T-square, parallel rule and/or drafting machine).

Principal Author(s): S. Vosen, J. Wheatley, C. Hetterling

GENERAL INSTRUCTIONS:

This unit consists of four Learning Activity Packages (LAPs). Each LAP will provide specific information for completion of a learning activity.

The general procedure for this unit is as follows:

1) Read the first assigned Learning Activity Package (LAP).
2) Begin and complete the first assigned LAP.
3) Proceed to and complete each of the remaining LAPs in the unit.
4) Take the unit tests as described in the Unit LEG "Evaluation Procedures".

PERFORMANCE ACTIVITIES:

.01 Design Considerations
.02 Detail Drawings
.03 Detailed Assembly Drawings
.04 Exploded View Drawings

EVALUATION PROCEDURE:

When post testing:

1. The student takes a multiple-choice post test and turns it in for correction.

2. The student takes a Unit Performance Test. Successful unit complation is meeting the listed criteria for the Performance Test.

FOLLOW-THROUGH:

The Unit Performance Test is a set of working drawings. Copies of these may be kept by you as examples of your work.

Begin the first assigned LAP in this unit and each LAP will be checked according to the Performance Test criterion.

79.01.14.00
(Supplement)
2-20-79

DRAFTING PORTFOLIO: WORLD OF WORK

Naturally, resume's and letters of application are essential for interviews. However, in the drafting field, a portfolio of your work may be the final determination on the decision to hire. You will need to present samples of your work showing the different techniques and applications. Listed below are the drawings most likely to show these. Present the one or two prints which apply most nearly to the job to the interviewer.

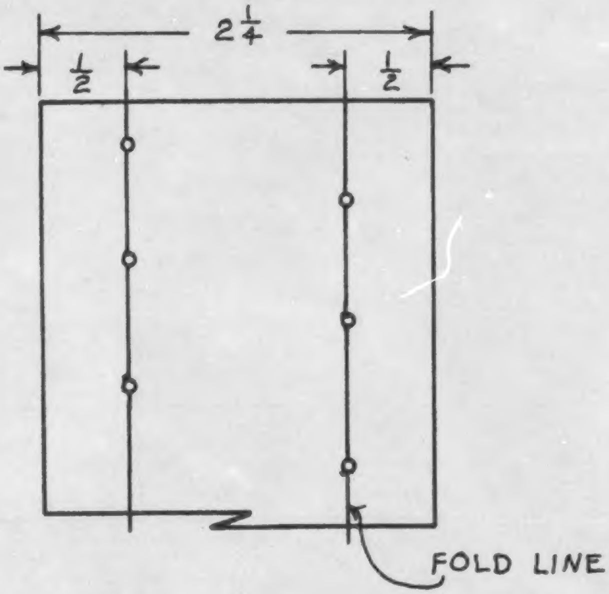
Unit 05	-- 3 prints	--	ink on vellum
Unit 06	-- 5 prints	--	lead on vellum (free-hand lettering)
Unit 11	-- 1 print	--	ink on mylar
Unit 12	-- 4 prints	--	ink on mylar (LeRoy lettering)
Unit 14	-- 3-4 prints	--	ink and lead on mylar

When you complete the course, you will have an original and one print of each drawing listed. In addition, you will make a Tuf-Tex original copy of the drawings in Unit 14. This Tuf-Tex will be kept on file here at FTC.

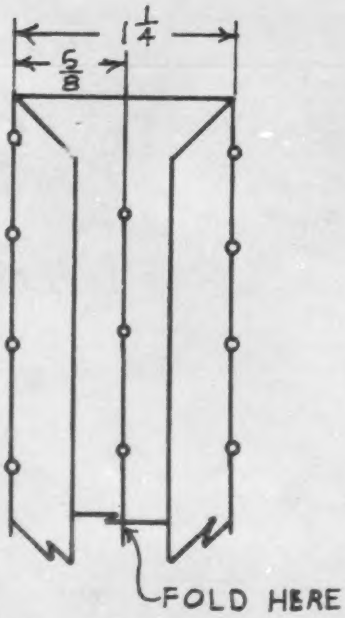
HOW TO BIND YOUR DRAWINGS:

1. Cut a strip of white paper (used blueprint paper works nicely) that is 2¼" wide and as long as the left hand edge of your drawing blueprints. You will bind this edge.

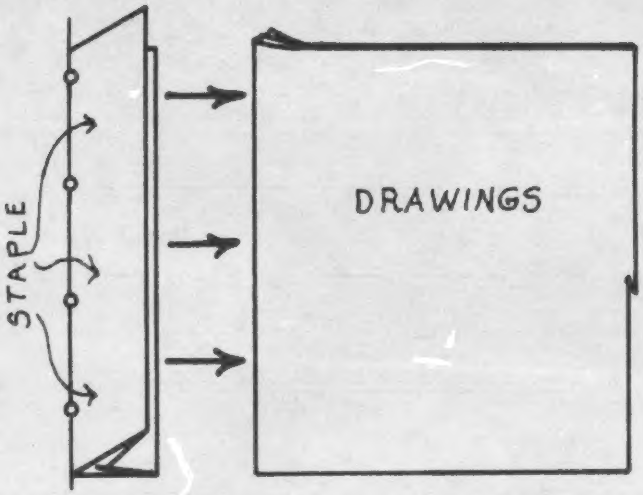
2. Fold the ½" edge of the strip of paper in -- towards the center.



3. Fold the 1" section at the center, with ½" edges folded inward.



4. Place folded binding over even edges of left side of blueprints. Staple the binding in several locations to secure drawings.



Student: ______________________ File Code: 79.01.14.00. A2-2
(.01-.06)
Date: ______________________ Date Published: 6/21/74

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UNIT/LAP PRETEST: WORKING DRAWINGS

1. A drawing for use in production should contain:

   a. at least one auxiliary view.
   b. top, front, and side views always.
   c. as many section views as possible.
   d. only those views needed for clear and complete shape description.

2. A drawing showing how all the parts fit together is called:

   a. a design layout.
   b. a complete drawing.
   c. a detail drawing.
   d. an assembly drawing.

3. Drawings that are line-shaded, lettered in script, and protect a manufacturer are called:

   a. security drawings.
   b. patent drawings.
   c. detail drawings.
   d. old-style drawings.

4. The number of details usually drawn on each sheet is.

   a. four.
   b. one.
   c. at least five.
   d. as many as will fit on the sheet.

5. An assembled machine or structure is shown on:

   a. an assembly drawing.
   b. a detail drawing.
   c. a staff section.
   d. a bill of materials.

6. Detailed drawings and assembly drawings are included in:

    a. a set of working drawings.
    b. a work flow diagram.
    c. a set of director drawings.
    d. all drawings made with a computer plotter.

7. On an assembly drawing, dimensions are:

    a. drawn in isometric.
    b. always drawn.
    c. not drawn, as a rule.
    d. drawn in orthographic.

8. A working-drawing **assembly** is:

    a. separate detail and assembly drawings.
    b. a combined detail and assembly drawing.
    c. the assembly drawing from a set of working drawings.
    d. the complete set of working drawings.

9. A drawing used to give a general idea of the exterior shape of a machine or structure is called:

    a. an outline assembly drawing.
    b. a bill of materials.
    c. an auxiliary view.
    d. a detail drawing.

10. A title is drawn on:

    a. every sketch and drawing.
    b. drawings but not sketches.
    c. working drawings only.
    d. section views.

UNIT/LAP PRETEST ANSWER KEY: WORKING DRAWINGS

1. D
2. D
3. B
4. D
5. A
6. A
7. C
8. B
9. A
10. A

File Code: 79.01.14.01

Date Published: 11-17-78

Family Education Program

Learning Activity Package

Student:

Date:

PERFORMANCE ACTIVITY: Design Considerations

OBJECTIVES:

To identify several areas of consideration when planning a working drawing. To familiarize the student with the design process.

EVALUATION PROCEDURE:

Correctly answer at least 8 out of 10 items on a multiple choice LAP test that measures achievement of the objective for this LAP. The instructor will review the students outline on the assigned problem and evaluate the results with the student.

RESOURCES:

Basic Technical Drawing -- Chapter 15.
Technical Drawing -- Chapter 14.
Engineering Drawing and Graphic Tech. -- Chapters 14 and 23.
Design Drafting, Chapters 6 and 14.
Mechanical Drawing, Chapter 13.

PROCEDURE:

1. Read the above resource(s).
2. Do a design evaluation of the lead pointer in your kit.
    a. List the functions it should provide.
    b. List the advantages and disadvantages of the present design.
    c. Make a free-hand sketch of an improvement or change in the present design.
3. Decide what information is necessary to make a set of working drawings. (List the working drawings needed and what would be placed on each).
   NOTE: The above work will be done in lead on white size "A" drawing paper. Use your best free-hand lettering style.
4. Review your work with your instructor.
5. Take the LAP test and proceed to the next LAP.

Principal Author(s): Jere Wheatley

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Date Published: 11-17-78

Revised: 8-13-79

Family Education Program

Learning Activity Package

Student: ____________

Date: ____________

PERFORMANCE ACTIVITY: Detail Drawings

OBJECTIVE:

Identify the characteristics and purpose of detail drawings. Prepare detail drawings.

EVALUATION PROCEDURE:

Correctly answer at least 8 out of 10 items on a multiple-choice unit test that measures achievement of the objective for this LAP and the other LAPs for this unit.

The instructor will examine the student's drawing for completeness, line work, dimensioning, lettering and accuracy using the Unit Performance Test Criterion Checklist.

RESOURCES:

Basic Technical Drawing, Chapter 14 and 15.
Mechanical Drawing, Chapter 13.
Technical Drawing, Chapters 10, 13, 14 and Appendix.
Engineering Drawing and Graphic Tech., Chapters 14, 15, 23, and Appendix.
GM Standards, areas as needed.

PROCEDURE:

1. Read the above resource(s).
2. Chose an object from those shown in Chapter 15 of Basic Technical Drawing.
3. Begin a preliminary of the detail drawing(s) in pencil.
4. Neatly arrange each drawing on one or more sheets of size B or C drawing paper.
5. Completely ink and dimension the drawings on mylar.
6. Make one blueprint copy of each completed ink drawing and submit it to the instructor for his critique.
7. Take the LAP test and procede to the next LAP.

Principal Author(s): S. Vosen, J. Wheatley, C. Wetterling

Family Education Program

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Date Published: 11-17-78
Revised: 8-13-79

Learning Activity Package

Student: ____________________
Date: ____________________

PERFORMANCE ACTIVITY: Unit (Detail) Assembly Drawings

OBJECTIVE:

Identify the characteristics and purpose of unit (Detail) assembly drawings. Prepare a unit assembly drawing.

EVALUATION PROCEDURE:

Correctly answer at least 8 out of 10 items on a multiple-choice unit test that measures achievement of the objective for this LAP and the other LAPs for this unit.

The instructor will examine the student's drawing for completeness, line work, dimensioning, lettering and accuracy using the Unit Performance Test Criterion Checklist.

RESOURCES:

Basic Technical Drawing -- Chapter 15.
Mechanical Drawing -- Chapter 13.
Technical Drawing -- Chapter 14.
GM Standards as needed.
ED and GT -- Chapter 23.

PROCEDURE:

1. Read the above resource(s).
2. Begin a preliminary of the unit (Detail) assembly drawing(s) in pencil
3. Prepare a bill of materials.
4. Completely ink the drawing on mylar.
5. Make one blueprint copy and give it to the instructor for his critique.
6. Take LAP test and procede to the next LAP.

Principal Author(s): S. Vosen, J. Wheatley, C. Wetterling

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Family Education Program

Learning Activity Package

Student: ______________

Date: ______________

PERFORMANCE ACTIVITY: Exploded View Drawings

OBJECTIVE:

Identify the characteristics and purpose of exploded view drawings. Prepare an exploded view drawing.

EVALUATION PROCEDURE:

Correctly answer at least 8 out of 10 items on a multiple-choice unit test that measures achievement of the objective for this LAP and the other LAPs for this unit.

The instructor will examine the student's drawing for completeness, line work, dimensioning, lettering and accuracy using the Unit Performance Test Criterion Checklist.

RESOURCES:

Basic Technical Drawing -- Chapter 15.
Mechanical Drawing -- Chapter 13.
Technical Drawing -- Chapter 14.
ED & GT -- Chapter 23.
Design Drafting -- Chapter 18.

PROCEDURE:

1. Read the above resource(s).
2. Begin a preliminary of the exploded view drawing(s) in pencil. Use Isometric representation.
3. Properly arrange all parts and proceed to make an ink drawing on mylar.
4. Make one blueprint copy and give it to the instructor for his critique.
5. Take LAP test and you have it made!

Principal Author(s): S. Vosen, J. Wheatley, C. Wetterling

Student: ______________________ File Code: 79.01.14.00. B2-2 (.01-.06)

Date: ______________________ Date Published: 6/21/74

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UNIT/LAP POST TEST: WORKING DRAWINGS

1. Working drawings of individual parts are referred to as:

   a. separate drawings.
   b. detail drawings.
   c. individual drawings.
   d. piece drawings.

2. A bill of materials is:

   a. how much you owe for the materials.
   b. a parts list.
   c. not used with working drawings.
   d. like any monthly bill.

3. An assembled machine or structure is shown on:

   a. an assembly drawing.
   b. a detail drawing.
   c. a staff section.
   d. a bill of materials.

4. The purpose of an assembly drawing is:

   a. to describe the shape of individual parts.
   b. to show how parts fit together and suggest the function of the entire unit.
   c. to show standard details.
   d. to provide a bill of materials.

5. On an assembly drawing, hidden lines are:

   a. left out completely.
   b. used as needed for clarity.
   c. always drawn.
   d. drawn as solid lines.

6. On an assembly drawing, dimensions are:

   a. drawn in isometric.
   b. always drawn.
   c. not drawn, as a rule.
   d. drawn in orthographic.

7. A working-drawing assembly is:

   a. separate detail and assembly drawings.
   b. a combined detail and assembly drawing.
   c. the assembly drawing from a set of working drawings.
   d. the complete set of working drawings.

8. All necessary information not given directly on a drawing with dimensions and notes is shown in:

   a. the parts list.
   b. the assembly drawing.
   c. the section view.
   d. the title and record strip.

9. A drawing used to give a general idea of the exterior shape of a machine or structure is called:

   a. an outline assembly drawing.
   b. a bill of materials.
   c. an auxiliary view.
   d. a detail drawing.

10. All the information necessary to make something is given in:

   a. a working drawing.
   b. an assembly drawing.
   c. an auxiliary drawing.
   d. a sectional drawing.

UNIT/LAP POST TEST ANSWER KEY: WORKING DRAWINGS

1. B
2. B
3. A
4. B
5. A
6. C
7. B
8. D
9. A
10. A

Student: ____________________ File Code: 79.01.14.00

Date: ____________________ Date Published: 2-26-79

Date Revised: 8-13-79

Family Education Program

UNIT PERFORMANCE TEST: WORKING DRAWING

OBJECTIVE:

The student should be able to make a working drawing which completely describes the object and complete it in an assigned period of time.

TASKS:

1. Given a sketch of the object, the student will provide the required orthographic drawing.
2. Given a sketch of the object, the student will provide the required isometric drawing.
3. Given an object, the student will provide the required isometric sketch and orthographic sketches with dimensions.
4. Given a representation of an object, the student will provide a Diazo print of the required orthographic drawing.

ASSIGNMENTS:

1. See page 2.
2. See page 4.
3. See page 6.
4. See page 6.

CONDITIONS:

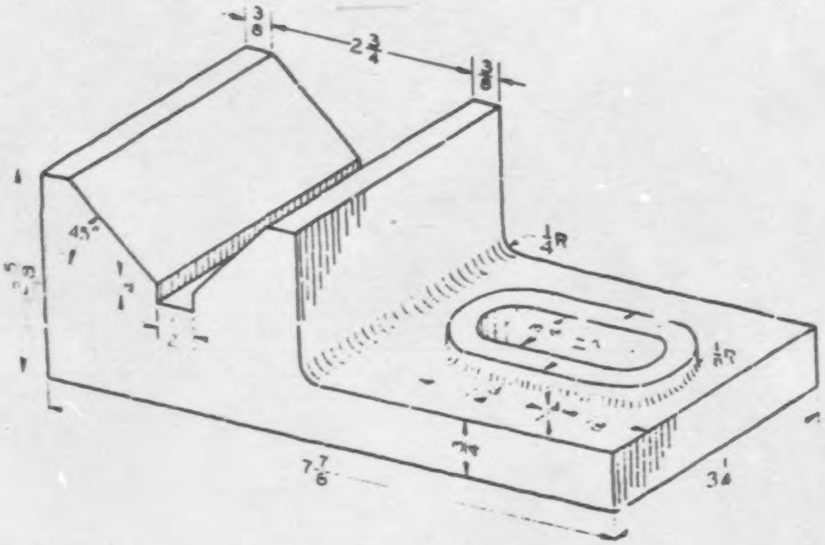
The drawings will be completed in the drafting area using the complete facilities. The instructor and other students may not be used as resources.

RESOURCES:

As listed in the Course LEG.

ASSIGNMENT:

Using the isometric sketch shown below, draw the required orthographic views in lead on a Size "A" sheet of drawing paper. No border or title block needed as this is a preliminary drawing. This drawing has a time limit of 1/2 hour. Check with your instructor before starting and at the end of the 1/2 hour. (Draw 1/2 size)



CAST BRASS

Student: ____________________ File Code: 79.01.14.00

Date: ____________________ Date Published: 2-26-79

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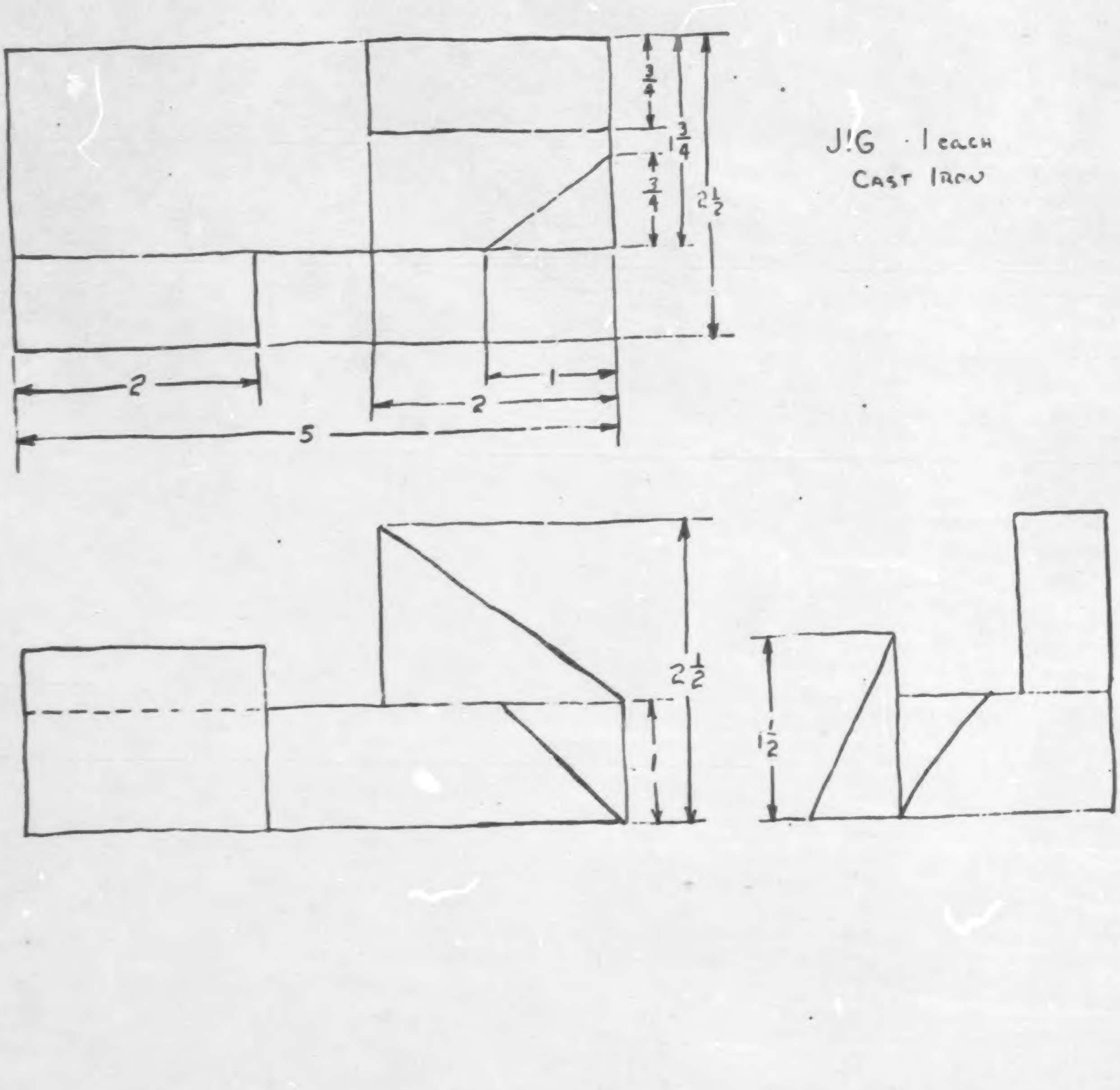
PERFORMANCE CHECKLIST: ASSIGNMENT I -- WORKING DRAWINGS

OVERALL PERFORMANCE: Satisfactory_____ Unsatisfactory_____

	CRITERION Met	 Not Met
Objective 1: Entire object is drawn in all 3 views (criterion No lines missing)		
Objective 2: Drawing is clean and neat (criterion - ASA standards - Technical Drawing, pages 12 and 22).		
Objective 3: Drawing is accurate to given dimensions (criterion: ± 1/64" and ± 1°.		
Objective 4: Hidden and center lines are neat, properly drawn, and of appropriate contrast (criterion ASA standards - Technical Drawing, page 20).		
Objective 5: Drawing completed in specified time (criterion: Not to exceed 1/2 hour).		
Student must meet 4 out of 5 criterion to perform satisfactorily.		

ASSIGNMENT 2:

Using the orthographic sketch shown below, draw an isometric view of the object in pencil on a Size "A" sheet of drawing paper. No border or title block needed as this is a preliminary drawing. This drawing has a time limit of 1/2 hour. Check with your instructor before starting and at the end of the 1/2 hour.



JIG 1 each
Cast Iron

Student: ____________________ File Code: 79.01.14.00

Date: ____________________ Date Published: 2-26-79

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PERFORMANCE CHECKLIST: ASSIGNMENT 2: WORKING DRAWINGS

OVERALL PERFORMANCE: Satisfactory_____ Unsatisfactory_____

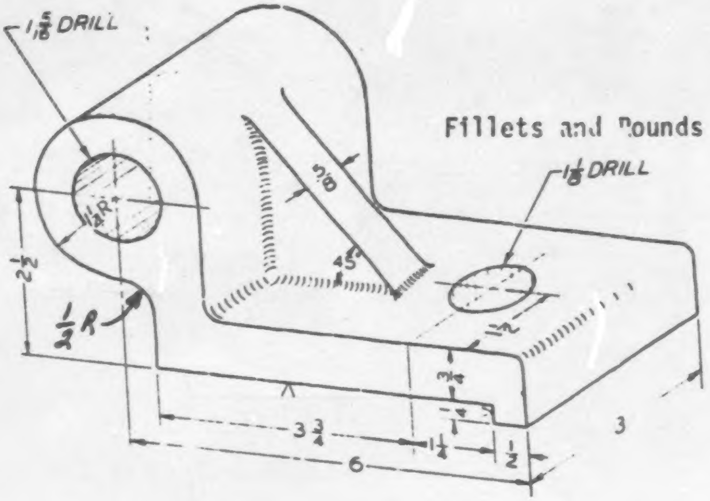
	CRITERION	
	Met	Not Met
Objectives:		
1. Entire object drawn. (criterion: no missing lines)		
2. Proper isometric techniques used. (criterion: articles		
169 and 170; Handbook of Drafting Rules)		
3. Drawing is clean and neat. (criterion: ASA Standards --		
Technical Drawing pages 12 and 22).		
4. Drawing is accurate to given dimensions. (criterion: ±		
1/64" ± 1°).		
5. Drawing completed in specified time. (criterion: not to		
exceed 1/2 hour).		
Student must meet 4 out of 5 criterion to complete satisfactorily.		

ASSIGNMENT 3:

Using the object provided by the instructor, take the necessary measurements and sketch the orthographic views with dimensions, then make an isometric sketch. The sketches will be done in lead on a size B sheet of drawing paper. No border or title block needed. These drawings have a time limit of one (1) hour. Check with your instructor before starting and at the end of the hour.

ASSIGNMENT 4:

Using the caliber drawing shown below, draw the orthographic views of the object in ink on size B vellum. Use the accepted border and title block. Make a Diazo print. This print has a time limit of two (2) hours. Check with your instructor before starting and at the end of two (2) hours.



Fillets and Rounds 1/8R

CAST ALUMINUM

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PERFORMANCE CHECKLIST: ASSIGNMENT 3: WORKING DRAWINGS

OVERALL PERFORMANCE: Satisfactory_____ Unsatisfactory_____

	CRITERION	
	Met	Not Met
Objectives:		
1. Entire object is sketched in both instances (criterion: No missing lines).		
2. Sketches are clean and neat (criterion: Para 5-1, Tech. Dwg.)		
3. Sketches are correctly proportioned (criterion: Paragraphs 5-4 and 5-10; Technical Drawings).		
4. Isometric sketches are made with proper techniques (criterion: Paragraphs 5-12 and 5-13; Technical Drawings).		
5. Orthographic sketches are made with proper techniques. (criterion: Paragraph 5-18; Technical Drawings).		
6. All necessary dimensions are shown on the orthographic sketch (criterion: Chapter 3, Handbook of Drafting Rules).		
7. Drawing will be completed in specified time. (Criterion: Not to exceed 1 hour).		
Student must meet 5 out of 7 criterion to complete satisfactorily.		

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PERFORMANCE CHECKLIST: ASSIGNMENT 4: WORKING DRAWINGS

OVERALL PERFORMANCE: Satisfactory_____ Unsatisfactory_____

	CRITERION	
	Met	Not Met
Objectives:		
1. Entire object drawn in all views (criterion: No missing lines).		
2. Drawing is centered (criterion: ASA Standards -- Technical Drawings, page 167).		
3. Drawings are accurate to given dimensions (criterion ± 1/64" and ± 1°).		
4. Diazo print is clear and neat. (Criterion: All lines visible and little or no background print).		
5. Drawing is inked correctly (criterion: border and title block to assigned format; object lines #1 pen, hidden lines #0 pen; center lines #00 pen).		
6. All lines are properly drawn (criterion: ASA Standards -- Technical Drawing, page 20).		
7. Drawing and print will be completed in specified time. (Criterion: Not to exceed 2 hours).		
Student must meet 5 our of 7 criterion to complete satisfactorily.		